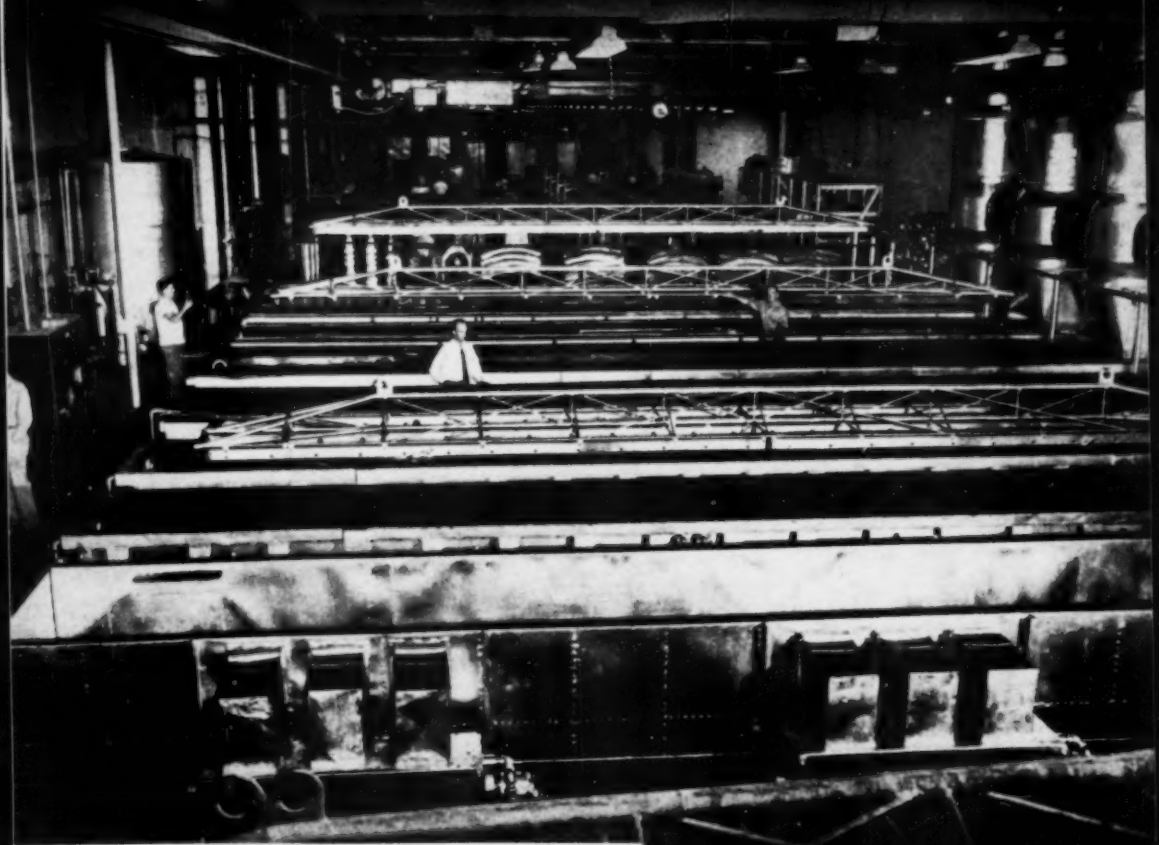
VOLUME 39
NUMBER 3

MARCH, 1952

plating



POSTMASTER: IF UNDELIVERABLE RETURN TO
5800 N. MERVINE ST., PHILADELPHIA 41, PA.
RETURN POSTAGE GUARANTEED

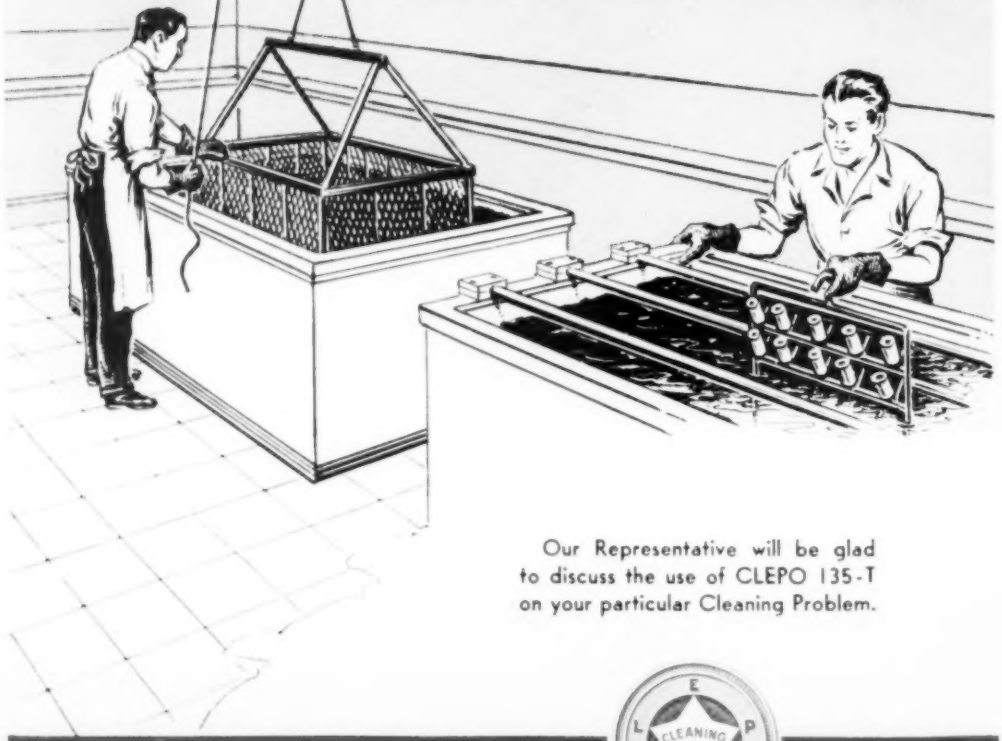
ALUMINUM TREATMENT

See Contents Page 247

CLEPO 135-T

A Soaking Cleaner for removing Buffing Compounds or oil from Ferrous and Non-Ferrous metals in either BASKET or RACK Cleaning.

CLEPO 135-T is especially effective in hard water areas.



Our Representative will be glad to discuss the use of CLEPO 135-T on your particular Cleaning Problem.

FREDERICK **GUMM**
Chemical Company Inc.
536 FOREST STREET, KEARNY, N J

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 300.

NEW RESEARCH PRODUCTS FOR

METAL FINISHING

ALKALINE DERUSTING COMPOUND 134

FAST ALKALINE PICKLE FOR IRON

Derusts and pickles steel, cast iron, alloy steels, tin coated steel, high carbon steels without any etching, darkening or attack on the base metal. Operates at room temperature. Fast action. No acids used. Ideal for reclaiming of tools, gears, fixtures and preparing work for plating, galvanizing, tinning painting and enameling.

ALUMOX "44"

SIMPLE COLORING PROCESS FOR ALUMINUM

Colors aluminum and its alloys many shades of gold, green, brass, yellow, blue . . . in seconds to minutes. No electric current needed. Bulk work easily processed. Send samples of your work to Enthone for coloring to see these beautiful finishes.

WRITE FOR BULLETINS ON THESE PRODUCTS AND A CHECK LIST OF LITERATURE ON SIXTY PRODUCTS FOR MODERN METAL FINISHING.

METAL FINISHING PROCESSES

ENTHONE

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ELECTROPLATING CHEMICALS

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Bonus Performance

Filtering any plating solution . . . any quantity

INDUSTRIAL Filters

Portable and stationary models. Capacities from 100 to 15,000 gph. Special filtering systems engineered to meet unusual conditions.

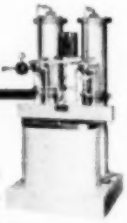
and it's performance that counts

The engineering, design, and construction of INDUSTRIAL filters have proved out in long service. With the outlet near the top of the chamber, a uniform precoat is deposited on the filter leaves as the solution fills the chamber. The outside lockup simplifies the lockup of the leaf and bag assemblies. INDUSTRIAL exclusive air-wash cleaning method practically eliminates the usual labor, downtime, and the inconveniences of dismantling the filter after each cycle. INDUSTRIAL filters are often in operation for months without removing the cover. All these features add up to bonus performance—clear filtrate at low over-all cost per gallon.

Ask for Bulletin 100-EP

This bulletin gives the complete details of all INDUSTRIAL features, description of the different standard models, and the capacities of the standard sizes.

INDUSTRIAL Water Demineralizers



Eliminate stains after hot rinses; prevent unwanted precipitates in solutions.

Standard INDUSTRIAL demineralizer units are available with capacities of 200 to 1000 gph. Special units of any capacity are engineered to requirements.

Write for Full Information and Recommendations

FILTERS Pressure Type · PUMPS Centrifugal · CORROSION TESTING APPARATUS Salt Fog • Humidity

RUBBER DIVISION Vulcanized Linings • Molded Products · WATER DEMINERALIZERS

INDUSTRIAL FILTER & PUMP MFG. CO.

5914 Ogden Avenue
Chicago 50, Illinois

Industry News

Plating Industry Representation in Washington. In the last few months there has been some discussion, and perhaps some confusion, because the N.P.A. Advisory Committee for the Electroplating Industry was made up solely of job platers with no representation either of manufacturing establishments doing plating or of supply houses or manufacturers of plating equipment, all of whom would be affected by any general legislation covering plating. In fact, the first official action recommended by that committee was one which would have affected a great many people other than job platers.

According to its President, A. P. Munning, The Metal Finishing Suppliers Association, Inc., has made a rather careful investigation at Washington, and whereas the condition is not as good as might be liked by some people, it is not as bad as the foregoing facts would seem to imply. The Association has been told by the N.P.A. that the advisory committee was never intended as a general plating committee and that, being attached to the Services Branch, it could only be composed of job platers and could not legally contain other elements of the industry.

It must be borne in mind that the functions of any advisory committee are purely informative and advisory, and under no circumstances have they the power to legislate. Their advice may be accepted or rejected by the N.P.A. entirely within its own discretion. The Association has been assured that before any legislation is enacted by the N.P.A. that would affect any element of the plating industry other than purely job platers, the Association, as well as others, would be called upon to express opinions.

Excellent Sales Opportunity:

CHEMICAL ENGINEER

Long established, nationally known manufacturer of corrosion resistant process equipment seeks personable and aggressive chemical engineer to sell and service Eastern territory. Headquarters are in New York. Sales experience desired. Knowledge of process industries required. Reasonable starting salary, insurance plan and other benefits available. Top advancement possibilities. Write, giving full details and photo, to

P-352-A, PLATING
P. O. Box 168, Jenkintown, Pa.

Published monthly at 5800 N. Marvine St., Philadelphia 41, Pa. Entered as second class matter July 1, 1946, at the Post Office at Philadelphia, Pa., under Act of August 24, 1916. Subscriptions: Domestic and Canada, $4.00 for 1 year, $7.00 for 2 years 50c per copy; Foreign, $8.00 per year. $1.00 per copy.

SARCO electric temperature control

ACCURACY AND SENSITIVITY BY SIMPLE ELECTRICAL MEANS

"Very successful in our operation, and I specify them on all our new equipment," says Thomas Allison, Plant Engineer of Southern Gravure Service, Louisville, Ky. ***(See photo at left)***

IN HIS CASE the operation is plating, an industry in which SARCO electric controls have found wide adoption.

There are many others: For example, dryers in the textile, tanning, food and chemical industries; dyeing and wet finishing processes in textiles; processing, distilling and evaporating in chemical plants.

SARCO's complete line includes also thermostats and solenoid or motor valves for space heating, air conditioning and refrigeration control.

Get the whole story by writing for bulletins 1025 and 1080.

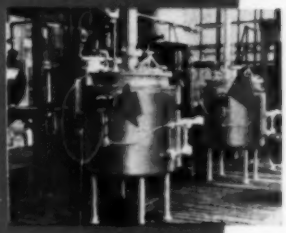
SARCO COMPANY, INC.
EMPIRE STATE BUILDING, NEW YORK 1, N. Y.
SARCO CANADA LTD., TORONTO 8, ONTARIO
REPRESENTED IN PRINCIPAL CITIES

PLATING

In copper and chromium plating of rotogravure rolls, the temperature of plating solutions is held to within ½°F by Sarco Electric Indicating Temperature Controllers. Photo taken in Southern Gravure Service plant, Louisville, Ky.

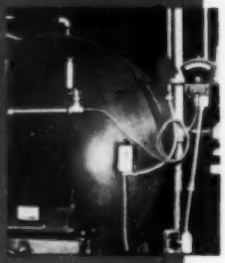
CHEMICAL

Hoffman La Roche Pharmaceutical Co., Nutley, N. J.—the jacket water temperature of these stills must be held to within ½°F. For the past 9 years, Sarco LSI Indicating Temperature Controllers have been doing that job.



FOOD

Chocolate milk and soft drinks in bottles and cans are processed in Fort Wayne Sterilizers. Many users equip these Sterilizers with Sarco LSI Electric Indicating Controllers to hold the temperature to within ½°F. Hook-up sketches and case histories on request.



TEXTILE

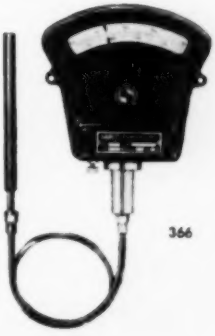
The Backus Hosiery Conditioner processes 15 denier nylon hosiery—40 dozen per 1 hour cycle. The humidity and dry heat are controlled by two Sarco Electric Indicating Temperature Controllers. Over 500 LSI's have been factory-installed on these Conditioners by Backus Machine Works, Carlstadt, N. J.

TYPE LSI

An extremely sensitive and accurate Electric Indicating Temperature Controller for temperatures from minus 90°F to plus 650°F. Controls electric heating elements, motors, solenoid or motor valves to maintain constant temperature.

A built-in thermometer makes setting easy and provides a continuous check on temperatures maintained without the bother of continually changing charts.

A double switch type L2SI is available for alternate heating and cooling control, or step control of heating or cooling.



366

Specialists in Industrial Cleaning Products

Wyandotte's new Research Building in progress

How Wyandotte's expansion program will help solve your cleaning problems

Up and down the line, we're doing everything we can to keep pace with the increasing needs and the new problems of industry.

New research facilities

Now under construction, for instance, is this new Wyandotte Research Building. When completed, it will contain the finest facilities for research into cleaning techniques and product application in the industry.

It will house complete metal-cleaning laboratories, a plant-size power washer, a complete set of plant cleaning and plating tanks, barrel-finishing equipment, corrosion-test facilities, a water-wash paint-spray booth — everything needed for developing, testing, and perfecting metal-cleaning and related products.

Production and service

Expanded production facilities, too, will help assure you of continuing dependable supply; and our newly augmented Technical Service Department will be able to give you, even more than before, the best technical help available.

All types of industrial cleaning, as well as barrel finishing, acid treatments, and paint stripping, are our specialties. Let our representative help you. *Wyandotte Chemicals Corporation, Wyandotte, Michigan; also Los Angeles, California.*

CLEANING THE WORLD

Largest manufacturers of specialized cleaning products for business and industry

Wyandotte CHEMICALS

Helpful service representatives in 35 cities in the U.S. and Canada

Industry News

Northwest Chemical Company, Detroit 4, Mich., has announced the appointment of the **Alert Supply Company**, Los Angeles, Calif., as Western Representative. Alfred E. Perkins, President

of this organization, has thirteen years' experience selling for L. H. Butcher Company of Los Angeles. Secretary-Treasurer Arthur D. Gaskin, who graduated with a degree in Chemistry Research from Oxford University, has been with

Perkins **Gaskin**

Bruce Products in Howell, Mich., makers of buffing compounds; H. A. Montgomery, Detroit, manufacturers of special lubricants; and L. H. Butcher, where the partners became acquainted.

The Alert Company has transferred its operations to its recently completed, modern headquarters in the Central Manufacturing District of Los Angeles.

A. J. Lynch & Company, manufacturers' representatives and distributors, has moved into a new location at 1495 Custer Avenue, San Francisco, Calif., where larger offices and storage facilities afford greater opportunity for service to

POSITION WANTED

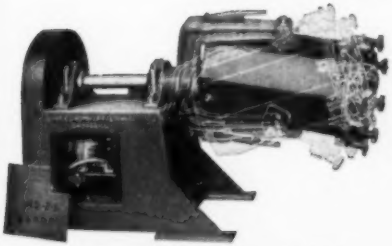
Chemist, presently concerned with electroplating control and research, seeks similar position with wider scope for his abilities. Experience in cadmium, tin, copper and other plating; previously textile, oil, food and non-ferrous chemical experience. Location: New Jersey, Long Island, Eastern Pennsylvania or New York. *Reply to:* P-352-B, PLATING, P. O. Box 168, Jenkintown, Pa.

USE "RELIANCE" PRODUCTS FOR

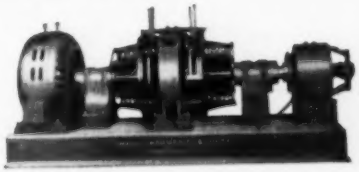
ECONOMY : EFFICIENCY : DEPENDABILITY

LET US SUPPLY YOUR NEEDS FOR YOUR PLATING OR POLISHING DEPARTMENT

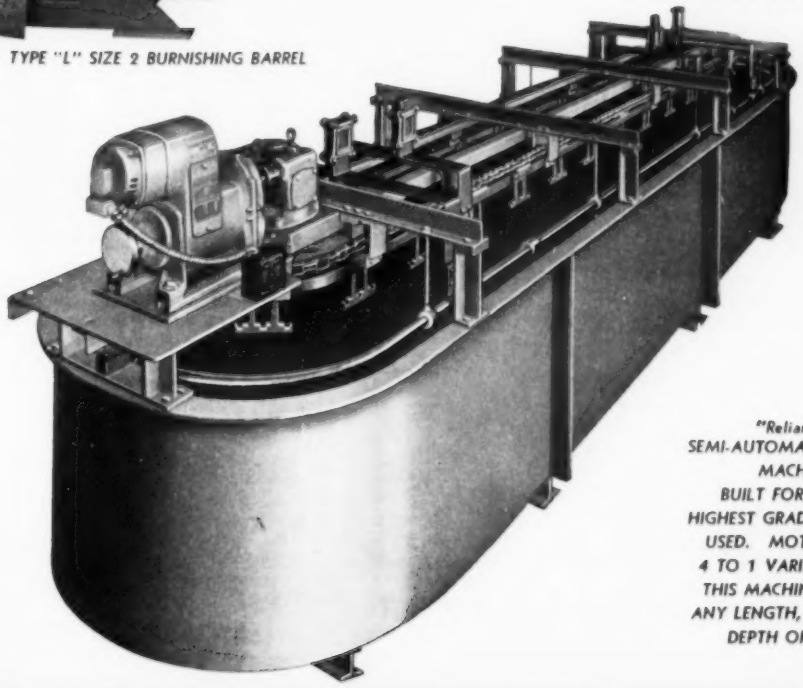
WRITE FOR FURTHER DETAILS



TYPE "L" SIZE 2 BURNISHING BARREL



3000 AMP. 6 VOLT GENERATOR SET



"Reliance"
SEMI-AUTOMATIC PLATING MACHINE
BUILT FOR SERVICE
HIGHEST GRADE MATERIAL USED. MOTOR ½ HP
4 TO 1 VARIABLE SPEED.
THIS MACHINE IS BUILT ANY LENGTH, WIDTH AND DEPTH OF TANK.

Chas. F. L'Hommedieu & Sons Co.

MANUFACTURERS of

Plating and Polishing Machinery

Complete Plating Plants Installed

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CHICAGO

Branches:
Cleveland
and
Los Angeles

FOR FURTHER INFORMATION, USE READER SERVICE CARD: INDICATE A 305.

Industry News

their customers. A complete line of electroplating and polishing equipment and supplies, including chemicals, are handled by the Company under the supervision of J. R. Pattenger.

Pennsalt Announces Metal Processing Department. The Pennsylvania Salt Manufacturing Company announces the consolidation of all sales and service in chemical specialties for metal cleaning, fabricating and processing in one sales department named the Metal Processing Department.

The department, headed by J. J. Duffy, Jr., Sales Manager, represents a merger of the Industrial Metal Cleaners Department and the Fos Products Department.

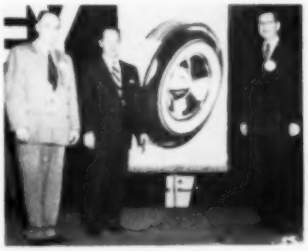
It was in the mid-thirties that the company began supplying chemical specialties to the metal industry with the introduction of a limited number of products for metal cleaning. This undertaking, which has since assumed departmental status, has steadily increased to include more than 30 alkaline cleaners, inhibited acid cleaners and emulsion cleaners.

The sales and service activities of the Fos Products Department, organized a year ago, include a number of Fos Process installations through the steel industry for compatible cleaning, pickling, phosphatizing and lubrication in the cold extension of steel, tube drawing, wire drawing and ordnance industries.

American Hard Rubber Celebrates and Moves. Finding its once luxurious offices no longer adequate to cope with its 100 years of growth and progress, American Hard Rubber Company has said good-bye to the offices it has occupied for 72 years on Mercer Street in downtown Manhattan, and moved to modern, efficient offices at 93 Worth St., New York 13, N. Y.

Producing a wide variety of products, from large rubber-lined tanks to the famous ACE hair combs, American Hard Rubber Company is the oldest rubber manufacturer now active. It is celebrating its 100th Anniversary this year. Though hard rubber is still its principal business, the company has pioneered in many of the newer plastics and rubber-plastic combinations, and supplies products made from nearly 100 different compounds.

Diversey Sales Meeting. Two new products—Divolond for phosphatizing steel prior to painting, and Diversey No. 101 for electrocleaning brass before plating—were introduced to the 300 U. S.



Dr. H. D. Sharer (center) of U. S. Rubber Company addressing 300 D-Men of The Diversey Corporation, Chicago, at the organization's 19th annual sales conference in December. On the left is W. E. Noyes, vice-president in charge of sales, and on the right, Chairman H. W. Kochs

and Canadian metal-industries sales representatives of The Diversey Corporation, Chicago, attending its 19th annual sales conference in December.

R. L. Shannon, head of Diversey's Metal Industries Department, conducted a comprehensive sales and technical review.

The O'Donohue Sales Company of Milwaukee, Wis., distributor of metal-finishing supplies and equipment, and its supplier, **The London Chemical Company** of Chicago, Ill., manufacturers of paint strippers and protective chemicals,

ARco
DETROIT
HOUSTON
ARCO rubber covered diaphragm plating installation, Ford Motor Co., Monroe Plant
Rubber Covered Utensils
Rubber Lined Pipe and Fittings
Rubber Covered Tank Cars
Rubber Protected Equipment For Electroplaters
Let ARCO engineers assist you in converting to the "Diaphragm" method of plating.
• For complete details ask your jobber or write for this Diaphragm booklet.
Diaphragm Plating Simplified
IN HOUSTON
ARco RUBBER PROCESSORS
4033 HOMESTEAD ROAD
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AUTOMOTIVE RUBBER CO., INC.
8401 EPWORTH BLVD · DETROIT 4, MICHIGAN

POSITION WANTED

Foreman plater, with wide experience in copper, nickel, chromium, gold, brass, zinc and cadmium plating on diecastings and hardware along with electroplating and anodizing is available. Location: Philadelphia, Lancaster, Allentown area. *Reply to:* **P-352-C, PLATING, P. O. Box 168, Jenkintown, Pa.**

for Better Plating Results

Change to **N-R**

SEYMOUR'S

Cold Solution Type

BARREL NICKEL BRIGHTENER

SEYMOUR'S N-R Bright Nickel for cold bath solutions saves you money and gives more uniform deposits in barrel plating of small articles. With an original addition of only 3 to 5 fluid ounces of N-R per 100 gallons of solution, a clean, even, decorative deposit of bright nickel up to .0001" can be obtained. Only 1 to 2 fluid ounces of N-R are needed per 100 gallons per load of work thereafter.

Seymour N-R cold type Brightener is simple to maintain and easy to control. Deposits are adherent to properly cleaned base metals, except zinc base direct, and may be chromium plated without prior buffing or wiping. Write for Bulletin No. 8 containing complete details.

Other Seymour Bright Nickel Processes are available for specific plating needs. Tell us your requirements.

Distributors

EATON CHEMICAL & DYESTUFF CO.
1490 Franklin St., Detroit, Mich.

CROWN RHEOSTAT & SUPPLY CO.
3465 N. Kimball Ave., Chicago, Ill.

MUNNING & MUNNING, INC.
202-208 Emmett Ave., Newark, N. J.

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977-81 Niagara St., Buffalo, N. Y.

ENTHONE, INC.
442 Elm St., New Haven, Conn.

THE GILBERT TRAMER CO.
1217 Main Ave., Cleveland 13, Ohio

BART-MESSING CORP.
229 Main St., Belleville 9, N. J.

THE SEYMOUR MANUFACTURING COMPANY, SEYMOUR, CONNECTICUT

SEYMOUR

AMERICAN CHEMICAL PAINT COMPANY
AMBLER ACP PENNA.

Technical Service Data Sheet
Subject: RUST PROOFING WITH PERMADINE®

INTRODUCTION:

Ferrous metal parts that have been Permadized in a zinc phosphate chemical solution and then "sealed" with a rust-preventive oil such as "Granoleum" are effectively protected from rust-damage. In addition, if the surface is accidentally chipped or scratched, rusting is confined to the exposed area.

Rust proof coatings find many practical applications. During World Wars I and II most small arms were rust proofed by phosphate coating and impregnated with chromic acid and a rust preventive oil, or cutback petrolatum. This not only provided excellent corrosion resistance but also yielded a dull black non-reflecting surface. Rust proof finishes are now used widely on hardware, firearms, cartridge clips, metallic belt links, miscellaneous forgings and castings, tools, unpainted replacement machine parts, and many other similar items such as bolts, nuts, and washers.

THE PERMADIZING PROCESS:

For the most effective rust proofing of large or small work in large or small production, "Permadine" is used in tanks in an immersion process, with the bath heated to 190°-210°F., coating time 20 to 30 minutes. The coated parts are then rinsed in clean water, and then in a controlled dilute acidulated solution. After drying, a suitable corrosion-resistant oil such as "Granoleum" is applied.

Operations can be carried out with the work in crates, or hung from hooks, utilizing an overhead rail and hoists. For large volume production, automatic equipment can be used to mechanize the line. Small parts can be treated in tumbling barrels.

"PERMADINE" MEETS SERVICE SPECIFICATIONS:

The protective "Permadine" finish meets U.S.A. 57-0-2C, Type II, Class B, and equivalent requirements of:

MIL-C-16232,
Type II
U.S.A. 51-70-1,
Finish 22102, Class B
AN-F-20
Navy Aeronautical M-564
JAN-L-548

"PERMADINE" DATA CHART

Type of coating	Zinc phosphate
Object of coating	Rust and corrosion prevention
Typical products treated	Nuts, bolts, screws, hardware items, tools, guns, cartridge clips, fire control instruments, metallic belt links, steel aircraft parts, certain steel projectiles and many other components
Scale of production	Large or small volume; large or small work
Method of application	Dip Barrel tumbling, racked or basketed work
Equipment notes	Immersion tanks of suitable capacity. Cleaning and rinsing stages can be of mild steel. Coating stage can be of heavy mild steel or stainless steel.
Chemicals required	"Permadine" No. 1
Pre-cleaning methods	Any common degreasing method can be used. Alkali cleaning ("Ridosol"); Acid cleaning ("Deoxidine"); Emulsion alkali cleaning ("Ridosol", "Ridoline"); vapor degreasing, solvent wiping, etc., are examples. Acid cleaning may need to follow other cleaning methods if rust or scale is present.
Bath Temperature	190° - 210°F.
Coating time	20 - 30 minutes
Coating weight range Mgs. Sq. Ft.	1000 - 4000
Technical Service Data Sheets	No. 7-20-1-2 T. M. No. 5

CHEMICALS ACP PROCESSES

WRITE FOR FURTHER INFORMATION ON "PERMADINE" AND YOUR OWN METAL PROTECTION PROBLEMS

CHEMICALS ACP PROCESSES

Industry News

entertained industrial guests at a cocktail and dinner party at The Milwaukee Athletic Club on January 18. The dinner was followed by the presentation of a colored film, "Steel", and a demonstration of a newly developed water-displacing chemical and wire-strippers. C. F. O'Donohue, President of the Milwaukee firm, acted as toastmaster for the evening, and Powell Blake and Robert Schuh, Vice-President and Technical Director of the London Chemical Company, presented the technical program.

Detrex Solvent Equipment Sales Up. The increase in the rate of solvent degreasing equipment sales for 1951 is four times that of 1947, according to figures made public by the Detrex Corporation, Detroit 32, Mich.

Texas Engineering and Manufacturing Company, Inc., P. O. Box 6191, Dallas, Texas, has just placed in operation what is believed to be the largest anodizing, Alodining and chromodizing installation in the Southwest.

The TEMCO installation consists of six 5,500 gal processing tanks, a steam dryer, an overhead-bridge crane and a centralized control panel. All tanks are 6 feet deep, with a 5½ foot solution depth to avoid spillage, and internal dimensions are 38 x 3½ feet.

Four of the tanks—alkaline cleaner, rinse, anodize and Alodine—are ventilated and have an overall external width of 6 feet, as does the dryer. The other two tanks—rinse and Deoxylyte—are not ventilated and have an overall width of 4 feet each.

The control panel, designed and fabricated by the TEMCO maintenance department, provides a single, centralized control for all three processes.

The Industrial Chemical & Supply Company, Tampa, Fla., distributors of paint and plating chemicals, is in the process of enlarging its warehouse facilities and expanding its product lines to meet better the growing needs of Central Florida.

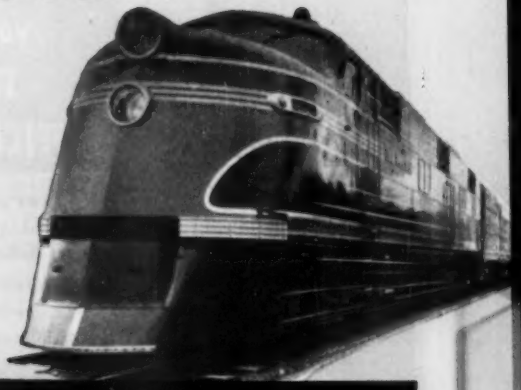
SITUATION OPEN

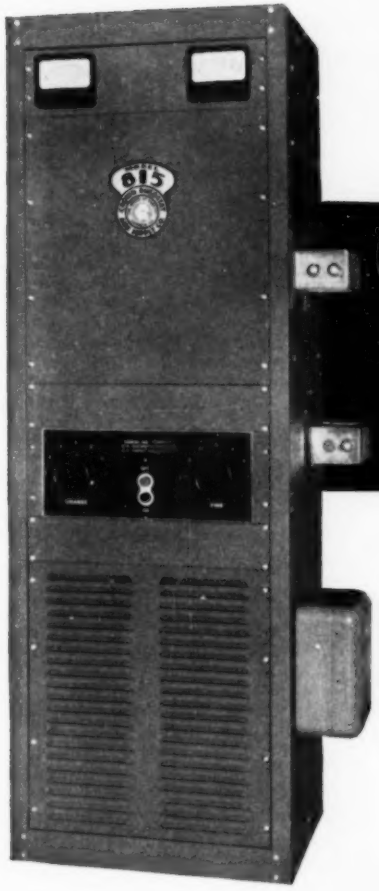
Southern New England manufacturer wants qualified chemist having experience with polishing and buffing compounds and their development and control with a minimum of supervision. An excellent opportunity. Write stating education, employment record, age, marital status. Applications considered confidential.

Reply to:
P-352-E, PLATING
P. O. Box 168, Jenkintown, Pa.

FOR FURTHER INFORMATION, USE READER SERVICE CARD, INDICATE # 308.

DON'T MISS THE "815"





CROWN'S Sensational "815" SELENIUM RECTIFIER

Dual Current Output: 1500 Amperes at 8 volts
750 Amperes at 16 volts

Dual Current Input: Connect to either 220 or 440 volts —60 cycle—three phase A.C.

Selenium Elements: High efficiency—Long Life

Controls and Rectifier in One Unit: Easy to operate, simple to maintain.

Write today for descriptive folder and complete details on this efficient, flexible selenium rectifier. It's another Crown product — noted for quality.

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3465 N. KIMBALL AVENUE • CHICAGO 18, ILLINOIS

INDICATE A 30%

Are you SURE you're using THE MOST EFFICIENT FINISH?

If your production involves finishing zinc, cadmium, aluminum or cuprous metals, you owe it to yourself... and your customers... to investigate

IRIDITE®

for on any of these metals Iridite gives you a high performance finish at a low cost from a simple chemical dip.

IF YOU WANT HIGH CORROSION RESISTANCE,
you'll find an Iridite that will meet any military or civilian specifications for chromate finishing.

IF PAINT ADHERENCE IS IMPORTANT,
you'll find Iridite prevents underfilm corrosion and soap formation.

OR, FOR BRIGHT, DECORATIVE FINISHES—

investigate zinc plate and Iridite (Bright) for a chrome-like decorative finish with more corrosion protection than conventional chrome plating . . . or Iridite (Metcote) as a treatment for copper that eliminates the need for buffing in the copper-chrome system; produces a sparkling bright finish!

Write for literature and data on samples for test processing. See "Plating Supplies" in your classified telephone directory or write direct.

Iridite is approved under government specifications.

ALLIED RESEARCH PRODUCTS
INCORPORATED
4004-06 E. MONUMENT STREET • BALTIMORE 5, MD.

Manufacturers of Iridite Process
for Corrosion Protection and Paint Systems on Non-Ferrous Metals; ANF Metal Conditioners

Personals

S. C. Taormina has been elected Executive Secretary of the Masters' Electro-Plating Association, Inc., of New York City to succeed the late Adolph Bregman.

He is a graduate of the Industrial Chemical Engineering School of Pratt Institute

Taormina

in 1923 and received a B.S. degree in Chemical Engineering from Polytechnic Institute, Brooklyn. After varied experiences in chemical engineering, he joined the U. S. Research Corporation in 1932, where he worked under Dr. L. C. Pan. Subsequently, Mr. Taormina collaborated with Dr. C. B. F. Young and developed several chromium plating and anodizing processes. In 1933 and 1934, he was active in association work among electroplating job shops and finally inducted his group into the Masters' Electro-Plating Association.

In 1937, Mr. Taormina organized Platters Technical Service, Inc. In 1947, he organized a similar laboratory in Chicago. He remains as Technical Director of both firms.

William P. Drake, Vice-President in Charge of Sales of the Pennsylvania Salt Manufacturing Company, Philadelphia, has been named Director of the Rubber, Chemicals and Drugs Division of the Office of Price Stabilization. He succeeds **Thomas H. McCormack** who is returning to his duties as Director of Sales of the Grasselli Chemicals Division, E. I. du Pont de Nemours & Company, Wilmington, Del.

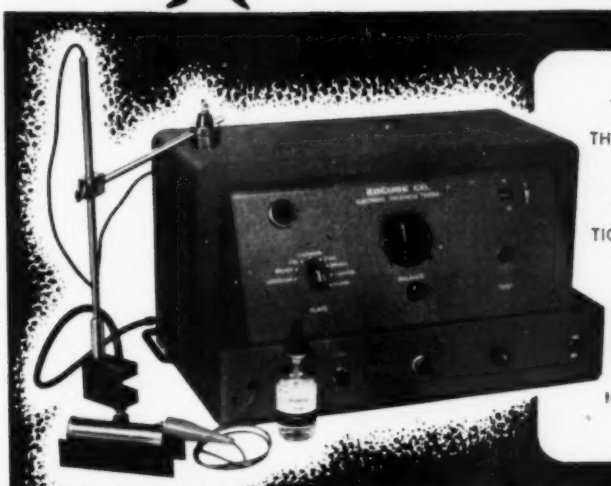
REAL SALES OPPORTUNITY

Here's a real opportunity for an aggressive man to earn more money. Well established chemical manufacturer has opening for outstanding sales representative in the New England territory. Complete line of alkaline and solvent emulsion type metal cleaners. Knowledge of metal finishing, plating, etc., essential. Prefer man with selling experience. Car furnished. State age, previous experience, other qualifications. All replies will be held strictly confidential. Write Cowles Chemical Company, Metal Cleaner Dept., 7016 Euclid Avenue, Cleveland 3, Ohio.

How to Solve Your Thickness Problems?

With the New KOCOUR Electronic Thickness Tester!

DETERMINES THE THICKNESS OF METALLIC COATINGS BETTER! . . . FASTER! . . . EASIER! . . . CHEAPER!



The new KOCOUR ELECTRONIC THICKNESS TESTER is the answer to your thickness problems . . . QUICKLY and almost AUTOMATICALLY . . . this highly accurate instrument can determine the thickness of all the commonly plated metals on various base metals . . . thus putting an end to costly rejects and reworking.

KOCOUR'S NEW ELECTRONIC THICKNESS TESTER HAS THESE OUTSTANDING FEATURES:

- Set is self-contained.
- 90-95% accurate depending upon type and thickness of the plate.
- Average test requires only about 1 minute.
- Minimum thickness determined is 500,000's of an inch (5,000,000 for chromium).
- Maximum thickness determined is indefinite.
- Operates virtually automatically.
- Reads directly . . . no calculations necessary.
- Relatively insensitive to surface roughness.
- Compactly housed in portable metal cabinet, 17"x10"x10".
- Operates from 105-125 volt, 60 cycle, A.C. electric outlet.

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No shortage of Brass plating chemicals here. True Brite Brass Makeup Solution and True Brite Brass Maintenance Solution are ready for immediate shipment. Simplify your brass plating by using these complete additions.

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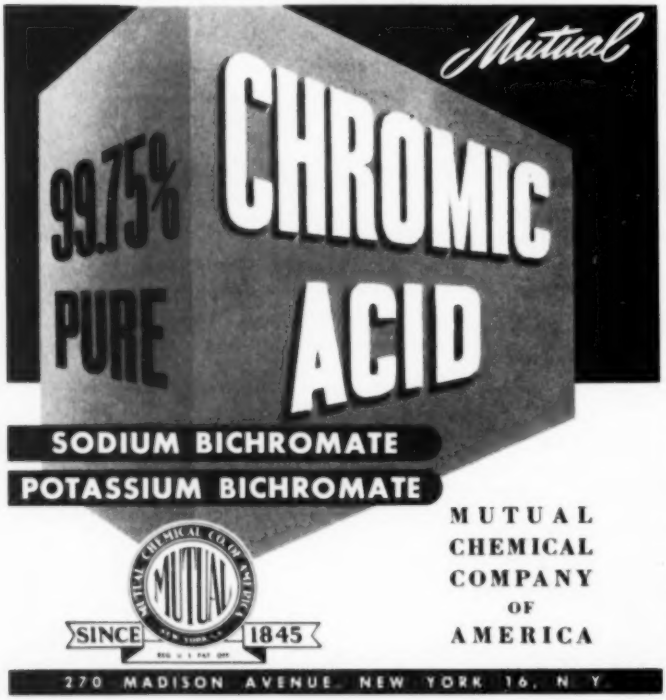

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 313.

Personals

Mr. Drake, who will serve as director until next July 1, joined the Company in 1934 in its student training course. Then, successively, he was a salesman, a Manager of Sales, and Assistant Vice-President in Charge of Sales, before his appointment as Vice-President in 1949. He is a member of the American Electroplaters' Society.

Harry W. Fish, Jr., is now Purchasing Agent of Divine Brothers Company, Utica, N. Y., manufacturers of buffing and polishing supplies and equipment, and

Fish

of the Munson Mill Machinery Company, Utica, a subsidiary of Divine Brothers.

He became associated with Divine in 1933, and has served in various capacities in the Metal Finishing Sales Department and the Order & Billing Department. In 1949 he was appointed Manager of the Customer Service Department.

Albert S. Kiefer recently joined the Chicago sales and service staff of the Industrial, Railroad and Aircraft Detergents Department of Wyandotte Chemicals

Kiefer

Corporation. Mr. Kiefer is a graduate chemical engineer, has done pilot plant work for Carnegie Steel and research and engineering for The Girdler Corporation. During World War II he was a major, Ordnance Corps, specializing in fuels and lubricants. Mr. Kiefer has recently done sales engineering for The Filter Paper Company of Chicago.

Luis E. Eckelmann, Director of Pyrene Manufacturing Company's Metal Finishing Division, has been elected a Vice-President of the Company.

Eckelmann came to Pyrene after graduation from the Polytechnic Institute of Brooklyn. He was a pioneer in phosphate

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In Case You're Not Aware of Flat•Top's Good Points...

- Distinctive shape makes confusion with cadmium or tin impossible.
- Original shape is retained right down to the nub.
- Smooth surface, free from gates and flash, prevents hanging on basket.
- Absence of pits and pockets eliminates inclusions of dirt, silicon, oxides and contamination from handling.
- Highest purity anode zinc available, processed under strict controls.
- Clean, new wooden containers, sealed against contamination. Easy to roll, truck and stack.

INDICATE A 314

The reasons for the almost unanimous acceptance of the FLAT•TOP Zinc Anode as The Standard are as sound today as they were back in 1948. Briefly, these advantages are its basic high purity, freedom from contaminating dirt, grit and injurious oxides, ease and economy of handling and, of course, the distinctive shape that eliminates the hazard of loading zinc tanks with other similar metals.

Two years after the introduction and acceptance of zinc FLAT•TOP, we achieved a *new* criterion of purity through the development of advanced equipment and processes. All contact with contaminating materials is now eliminated by this special melting equipment and our strict metallurgical control over all stages. While recognizing the rarity of perfection in this world, we believe that no other zinc anode is produced under better conditions or with better equipment.

Now represented from coast to coast, Wagner branches listed below are prepared to give you fast and complete service. Our representative in your area is qualified to consult with you on your plating anode problems. Write for his name and details on our anodes in nickel, copper, tin, cadmium, and brass, specials and standards.

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ORIGINATORS OF THE ROTO-FINISH PROCESS

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 315.

Personals

rust-proofing; helped organize the Metal Finishing Division of The Pyrene Company Limited, England, and the Bright Nickel Corporation, now a subsidiary of The Udylite Corporation.

Goble Russell (right) and **Carl Teschner** (left) recently received wrist watches in observance of their 25th anniversary in the employ of The Buckeye Products Company, Cincinnati, manufacturers of buffing and polishing compositions. Russell is now Shop Superintendent, having started in 1926 as a laborer, and Teschner is a machinist.

President Arthur Hoffheimer, who presented the watches, himself observes a double celebration at this time. He, too, is a 25-year man, and he was 70 years old the middle of January. He is the father of Arthur, Jr., also an official of The Buckeye Products Company.

S. S. Mitwol has recently been appointed Chief Engineer of the Bart-Messing Corporation, Belleville, N. J., manufacturers

Mitwol

of Sel-Rex selenium rectifiers. Mitwol, who has been responsible for many developments in the rectifier industry, became associated with the company in 1948.

Dr. John Kronsbein has been made Chief Engineer of Chicago Midway Laboratories, The University of Chicago, 6040 S. Greenwood Ave., Chicago, Ill. Until June 1, Dr. Kronsbein is continuing part of his teaching activities and fulfilling his duties as Head of the Engineering Department at Evansville College, Evans-

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UNIFORM PLATING. Avoids defects, conserves costly, hard-to-get plating metal. Saves plating time.

LABOR SAVING. Faster racking and unracking.

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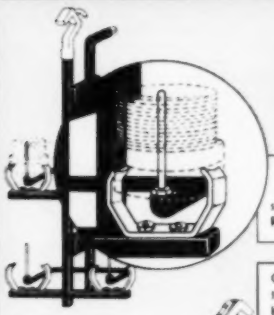
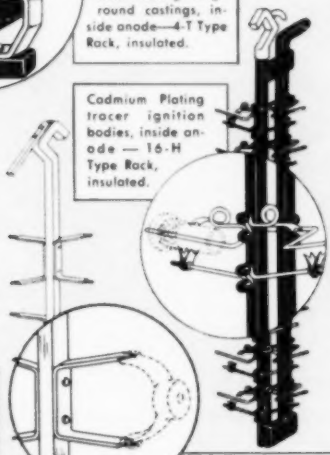
RESULTS TALK—

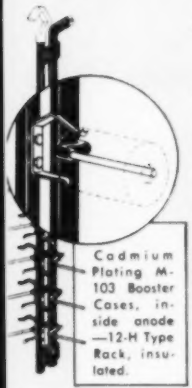
Send sample part with plating specifications for recommendation or ask us to send a Service Engineer.



Zinc Plating large round castings, inside anode—4-T Type Rack, insulated.



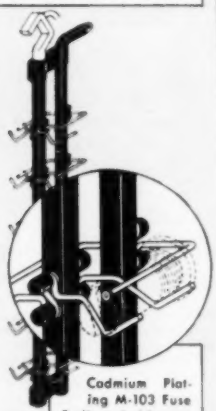
Cadmium Plating tracer ignition bodies, inside anode — 16-H Type Rack, insulated.



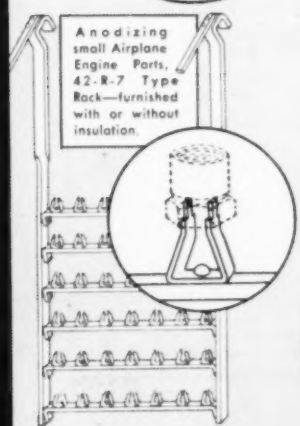
Cadmium Plating M-103 Booster Cases, inside anode —12-H Type Rack, insulated.

Anodizing Airplane Engine Parts, 8-H Type Rack—furnished with or without insulation.

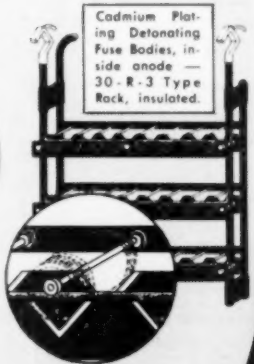
Cadmium Plating Fuse Liners, inside anode — 15-R-5 Cradle Type Rack, insulated.



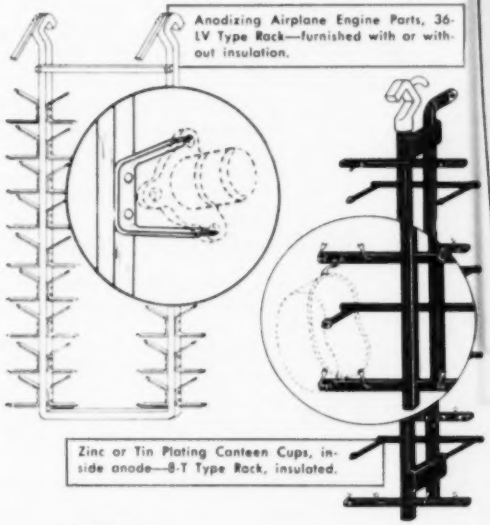
Cadmium Plating M-103 Fuse Bodies, inside anode — 12-H Type Rack, insulated.



Anodizing small Airplane Engine Parts, 42-R-7 Type Rack—furnished with or without insulation.



Cadmium Plating Detonating Fuse Bodies, inside anode — 30-R-3 Type Rack, insulated.



Anodizing Airplane Engine Parts, 36-LV Type Rack—furnished with or without insulation.

Zinc or Tin Plating Canteen Cups, inside anode—8-T Type Rack, insulated.

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RINS-AID has amazing properties in giving a water-repellent film to freshly plated work when dipped in a static rinse tank containing only 10 ounces of RINS-AID per 100 gallons of water.

Why Do Plated Parts Need RINS-AID?

Rinsing is an essential step in every plating operation but presents its own problems of drying and staining of practically all metals. RINS-AID solves these two problems simply because the water repellent surface it forms on freshly plated parts makes almost all of the water flow instantly from the surface before staining occurs.

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RINS-AID imparts a buffed appearance to chrome, gives a uniform velvety appearance to cadmium, eliminates buffing of stained parts, in many cases eliminates sawdust drying, removes water from the inside of tubes and other inaccessible areas, and makes active electropolished or bright dipped surfaces dry better without staining. The final hot water rinse is kept cleaner and operates cooler, avoiding rapid rusting and scaling of steel tanks. IT IS ALSO AN EXCELLENT RUST PREVENTIVE FOR STEEL TO PROTECT UNPLATED AREAS!

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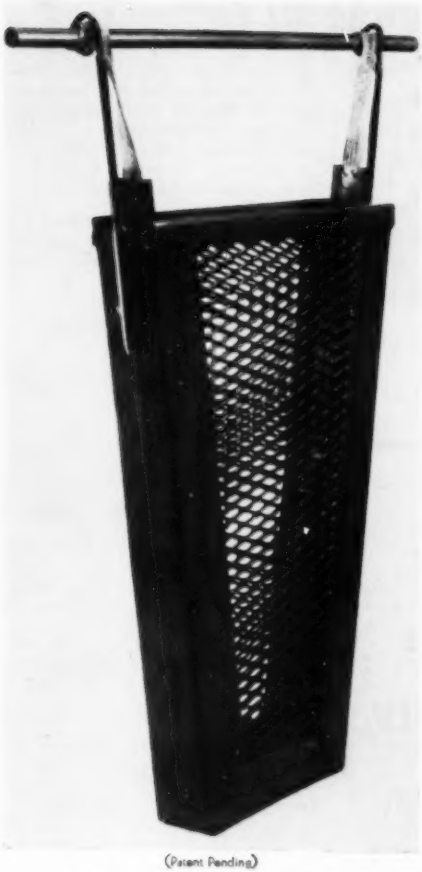

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The Forcite Anode Basket is expressly designed for efficient, complete solution of scrap or ball anode material. It may be used in nickel, acid copper, lead, and all cyanide baths. It dissolves all anode material to the last ounce.

Fabricated from reinforced steel, the Forcite Anode Basket is completely coated with an inert, insulating material. Its tapered construction is ideally suited to give continuous electrical contact to the anode mass without requiring replacement of "contact" anodes. Contact is made by perfectly shielded, inert graphite blocks the entire depth of the basket and coupled to the anode bars. Cotton bags are included.

Forcite Anode Baskets are available in either 24" or 30" lengths.

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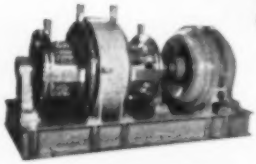

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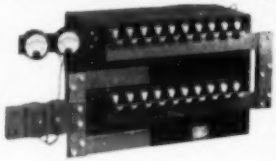

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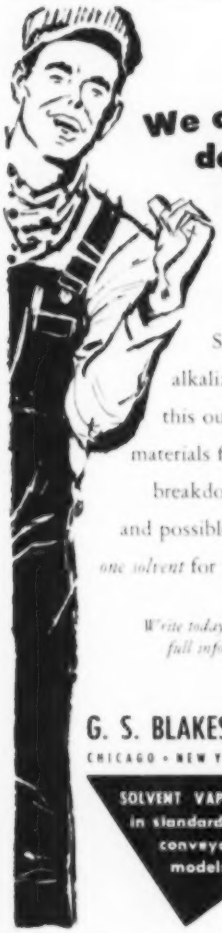

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Highest Stabilized Degreasing Solvent—BLACOSOLV is stabilized not alkalized—Years of research have produced this outstanding solvent. Contains no alkaline materials for the purpose of neutralizing acid *after* breakdown. Stabilizers prevent breakdown and possible acid formation. Blacosolv is the *one solvent* for *all metals* or *combination* of metals.

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Personals

ville, Ind. The new position involves direction of engineering activities in connection with a special research project for the United States Air Force undertaken by The University of Chicago.

Dr. Kronsbein is known in plating circles as Project Director of A. E. S. Research Project No. 11.

Howard E. Hastedt and **Willard C. Van Keuren** recently became managers of Wyandotte Chemicals Chicago and Philadelphia districts.

Hastedt

Van Keuren

Hastedt, new Chicago district manager, joined Wyandotte Chemicals in 1945 as a Sales and Service Supervisor in Pittsburgh, Pa. In 1950 he was transferred to the home office staff, in charge of a section of the Technical Service Department. Van Keuren has been a Sales and Service Supervisor in Wyandotte Chemicals Boston district since 1945.

G. T. Robinson, former Chicago manager for Wyandotte Chemicals, resigned to become general manager of a creamery company in Cleveland, Ohio, where he resided for 17 years. Similarly, **Joseph Hickson,** former Philadelphia manager, resigned to found his own business in the Philadelphia area.

Lloyd A. Dunn has joined Wyandotte Chemicals Corporation's Chicago District sales and service staff.

Dunn

A chemistry graduate of Albion College, Dunn has been a technical field representative in the electroplating industry for the past five years. He previously spent four years with the Armour Research Foundation on metallurgical problems.

Frank Boothroyd, formerly Foreman of the Silver Plating Department of the Gor-

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WE'LL SHOW YOU HOW TO DO IT FASTER, BETTER, MORE ECONOMICALLY

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Personals

ham Manufacturing Company, Providence, R. I., is now Assistant Superintendent of the Sperry Manufacturing Company, of the same city.

Theodore R. Treadwell has been appointed Sales Manager of the Clover Manufacturing Company, Norwalk, Conn., for its entire line of products, including coated abrasives. A graduate of Rutgers University and the Harvard School of Business Administration, he was for several years associated with Divine Brothers Company, Utica, N. Y., as Chicago District Representative.

G. W. Jernstedt has been appointed Manager of Engineering of the Special Products Development Division of Westinghouse Electric Corporation. This fills the vacancy created by the transfer of **Dr. S. W. Herwald** to the Air Arm Division. In addition to his new responsibilities, Mr. Jernstedt will continue in charge of Electroplating Projects. He will be located at the Manufacturing Engineering Laboratory Building on Ardmore Blvd., East Pittsburgh.

Jernstedt

Mr. Jernstedt graduated from Newark College of Engineering in 1937 and obtained his Master's degree in chemical engineering at Michigan State College in 1940 on a Lamme scholarship. He was employed in the Plating Department of the Meter Division from 1936 to 1943, at which time he was transferred to Engineering Labs and Standards. Since 1947 he has been section manager in charge of Electroplating Projects.

Burton E. (Al) Drury, Jr., has been named Sales Manager of United Platers, Inc.

Drury

A native of Birmingham, Mich., he formerly was with Wilson Foundry & Machine Company in Pontiac for nine years, the last five as Sales Manager. Prior to that, he worked in sales promotion and advertising, including two years with the Hudson Motor Car Company.

Clifford T. Olsen, metallurgist, has joined the sales force of Automotive Rubber Company, Inc., Detroit. He will work with manufacturers in engineering, installing and placing in operation the company's rubber-lined and processed tanks and other industrial equipment.

Olsen

Olsen was formerly associated with Hanson-Van Winkle-Munning Company at its Mattawan plant. He is an engineering graduate of Lafayette College.

Harvey J. Robillard is now Ceramic Engineer of the Exolon Company, Tonawanda, N. Y., where much of his time will be devoted to assisting companies in their use of Exolon abrasive and refractory products.

After graduating from Alfred University in 1948, Robillard joined the Bay State Abrasive Products Company as a Ceramic Engineer.

Richard South, formerly an expeditor for the Belden Brick Company, Canton, Ohio, has joined the Atlas Mineral Products Company's Sales Department, and will be assigned to a territory in Southern Ohio, West Virginia and Kentucky on the sales of corrosion-resistant materials and related products.

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CHROMIC ACID

TECHNICAL GRADE—FLAKE

We have yet to have a legitimate complaint on the quality of B.F.C. Chromic Acid. Its chemical analysis is as fine as its physical appearance!

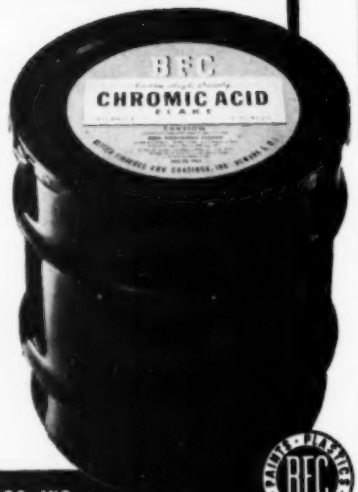
DEPENDABLY UNIFORM

Our plant is modern; beautifully equipped; operated by men who are proud of the product they make.

FRIENDLY, PERSONAL SERVICE

You can get a quick, unequivocal "Yes" or "No" on your Chromic Acid requirements from interested owner-principals who value your business.

One Price. One Standard of Quality and Service to all—whether the market is short or long. Distributor Stocks in many Principal Cities.



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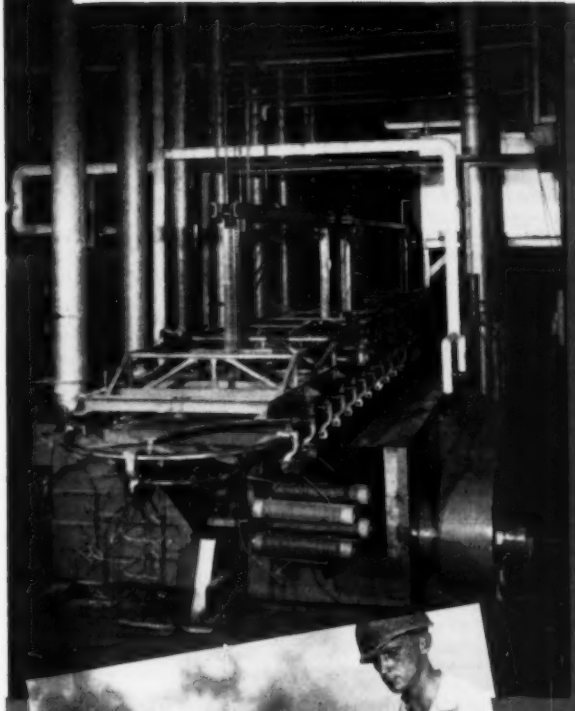
WITH
MASS PRODUCTION



One of the newest infantry weapons is the recoilless rifle. The gun has no kickback since gas pressure escapes through perforations in the shell casing.

UDYLITE EQUIPMENT PROCESSES SHELL CASINGS FOR ARMY'S RECOILLESS RIFLES

This Udylite Full Automatic Plating Machine plays a big part in speeding the flow of munitions from the Production Line to the Firing Line. This installation, at Servel, Inc., Evansville, Indiana, is used in manufacturing shell casings for the Infantry's new portable artillery. Because of the extreme heat and pressure generated in firing, shell casings must have a tough, durable finish . . . and Udylite's engineering "know-how" provided a unit that meets this exacting requirement with all possible efficiency. Casings are cleaned, pickled and bonderized, prior to lacquering, *automatically*—in one operation. The savings, in time, money and manpower, are obvious.

Udylite can bring the same benefits to your plant. Udylite machines, methods and materials provide a faster, *better way* in *plating*, anodizing, blackening, cleaning, pickling or processing of any nature. Talk it over today with your nearby Udylite Technical Man. There's no obligation.

PIONEER OF A BETTER WAY IN PLATING

THE *Udylite* CORPORATION
DETROIT 11, MICHIGAN

We honestly believe that LUSTER-ON® offers you the most uniform and brightest finish for zinc plate at the lowest cost, under good or adverse conditions. What's more we'll prove it! Just ask us.
The Chemical Corporation – 57 Waltham Ave., Springfield 9, Mass.

Trade Literature

L—738. Buffing Compositions for Chromium Plate and Stainless Steel—The Hanson-Van Winkle-Munning Co., Matawan, N. J., presents in Bulletin C-100 a rounded-out line of buffing and polishing compositions for the plating and polishing industry. Of special note are the compositions for chromium plate and stainless steel, as follows:

6-B-72, said to give extremely high coloring and to be made from the finest aluminum oxide flour. With no scratching, it is suitable for use on highest grade chromium finishes ranging up to jewelry.

6-B-86 is a white production rouge with a hard binder for carbon or stainless steel or chromium plate, claimed to be excellent for plumbers' goods and automobile accessories requiring high color, and economical.

6-B-66, made from specially selected aluminum oxide flour, is said to be well balanced for general use where fast cutting and good coloring are desired, and economical.

6-B-97 is claimed to be exceptionally fast cutting for carbon or stainless steel. It is molded in rectangular shaped bar for hand or automatic application and has fair color. Economical.

L—739. Spray Painting—"Sprayways", a graphic 16-page rotogravure brochure introduced by the Spray Painting Equipment Division of the DeVilbiss Company, Toledo 1, Ohio, is a ready reference to many spray-equipment uses. Nearly 100 photographs show scenes in industrial plants, on the farm, in shipyards and in many other places where spray-painting equipment is being employed.

The publication stresses the DeVilbiss engineering of its equipment to the user's needs, with one page devoted to the company's new Customer Research Center and Spray Painting School, where all sorts of finishing problems are handled and where automatic spray-painting machines illustrated in the brochure are on display. One section has scenes taken inside the DeVilbiss plant showing rigid quality control and manufacturing procedures. For your copy, use Reader Service Card.

L—740. Stripping of Electrodeposits—The Defence Research Laboratories have just published Information Circular 16 entitled "Stripping of Electrodeposits" by R. H. Keller. Published methods for stripping brass, bronze, cadmium, chromium, copper, gold, lead, nickel, palladium, platinum, rhodium, silver, speculum, tin and zinc from the base metals on which they are usually plated are collected in a handy form in this publication. Some comments are made on methods tried at D. R. L. Copies may be obtained free by writing to Chief Superintendent, Defence Research Laboratories, Private Bag No. 4, P. O., Ascot Vale, W.2, Victoria, Australia.

L—741. Emergency Showers—The emergency and decontamination showers manufactured by Logan Emergency Showers, Inc., of Glendale, Calif., are said to utilize the most modern techniques of spraying water to quench fire rapidly, or to dilute and remove, in a matter of seconds, acids or other chemicals and foreign materials contaminating clothing or the human body.

They are offered in three basic models to meet the requirements of maximum, medium or minimum exposure. Ingeniously located sprays enables Series 5010, shown here, to wet and wash all portions of the clothing and body, instantly and simultaneously. Tests with a high-viscosity water-soluble test material showed all material completely removed from all parts of the body, without rubbing, in only 15 seconds. With Series 5026, a total of 28 seconds was required to remove the test material from all parts of the body. In Series 5040 all sprays are directed downward for instantaneous wetting and washing of the upper portions of the clothing and body. Further wetting is from runoff water and the ability of the user to expose himself to water spraying from overhead. All models can be furnished in any metal and finish desired. Full specifications are given in Bulletin 30. For your copy, use Reader Service Card.

L—742. Carbon and Graphite Products—A 20-page Catalog Section S-5005, describing and illustrating "National" Carbon and Graphite and "Karbate" Impervious Carbon and Graphite products, is now available from National Carbon Company, a Division of Union Carbide and Carbon Corporation, 30 E. 42nd St., New York 17, N. Y. These products include impervious graphite heat exchangers, pipe, fittings and valves, cen-

How to Determine Impurities in Electroplating Solutions

Of all methods for determining minute impurities in plating baths, the most practical is the *colorimetric*. The principle utilized is simple: color intensity, due to presence of a colored constituent, is directly proportional to the concentration of that constituent.

USE OF THE COLORIMETRIC METHOD

This method requires the measuring of light transmitted by solutions.

Intensity of the transmitted light is measured by photoelectric means to attain a high degree of accuracy. No two solutions of different character will have transmittancy curves of exactly the same shape, hence, a solution under test is usually compared to a reference solution free of impurities. Calibration curves plotted from a series of runs facilitate determinations. Summaries of techniques used to determine four different impurities follow:

LEAD IN NICKEL PLATING BATHS

Lead is separated from interfering ions by extraction with a carbon tetrachloride solution of dithizone in the presence of potassium cyanide. After removal of the excess dithizone with alkaline potassium cyanide, the transmittancy of the solution is measured and the quantity of lead present determined from a calibration curve.

IRON IN NICKEL PLATING BATHS

Iron is separated from the other metallic ions by precipitation with cupferron. The iron cupferride is extracted with amyl acetate and then returned to the aqueous solution by shaking the amyl acetate extract with nitric acid. The iron is then reduced with hydroxylamine hydrochloride. O-phenanthroline is added, and the pH is adjusted with sodium acetate. Finally, the light transmission of the ferrous o-phenanthroline complex is measured.

MANGANESE IN NICKEL PLATING BATHS

The manganese is oxidized to permanganate by sodium periodate in an acid mixture of phosphoric and perchloric acids. The transmission of the solution is then measured.

COPPER IN NICKEL PLATING BATHS

Copper is isolated from the other constituents in the plating bath by precipitation with 2-mercaptobenzothiazole and extraction of the precipitate with amyl acetate. The color is then developed by addition of dibutyl amine and carbon disulfide. After the solution has been diluted with ethyl alcohol, its transmittancy is measured.

A.E.S. RESEARCH PROGRAM

The American Electroplaters' Society is conducting a comprehensive research program and has developed useful information on current plating problems. International Nickel, in addition to its other support of this program, feels that it will be a further service to make copies of these A.E.S. Research Reports available.

For an authoritative, detailed, 48-page study of this subject, we offer you a free copy of the A.E.S. Research Report, Serial No. 3, entitled *"Determination of Impurities in Electroplating Solutions."* Send the coupon now.

SYMBOL OF INCO SERVICE

The International Nickel Company, Inc.
Dept. P, 67 Wall Street
New York 5, N. Y.

Please send me a copy of A.E.S. Report, Serial No. 3, entitled "Determination of Impurities in Electroplating Solutions."

Name ..... Title .....

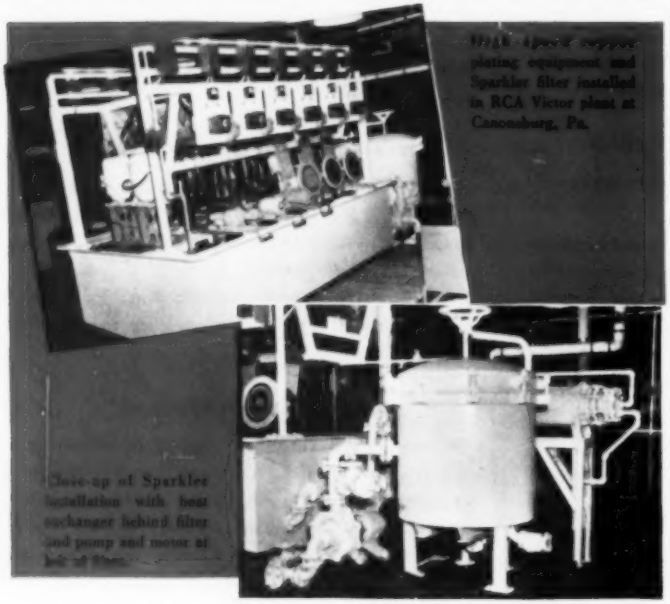
Company .....

Address .....

City ..... State .....

THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK 5, N. Y.

BETTER MUSIC
with an assist from
SPARKLER FILTERS



Sparkler filters installed in the Radio Corporation of America's phonograph record plants are one of the reasons why all RCA Victor recordings so faithfully reproduce the tone and quality of the original sound.

Here's why: One of the initial steps in this manufacturing process is the production of a large number of molding dies. The first die is made by electroforming an exact negative of the original soft lacquer recording; then, other electroforming operations produce the additional dies needed.

Since the smoothness of the grooved surfaces is one of the factors that determine the amount of noise produced by the record when played, and since any foreign particles in the plating solutions will introduce roughness into the electroformed parts, it is obvious that extremely clean nickel and copper plating solutions must be obtained.

Sparkler handles this job easily, because the horizontal plate principle is especially designed to provide finest quality filtration under all types of operating conditions. Operators know that there is never any variation in quality with a Sparkler filter, even under fluctuating pressures or intermittent operation, since filter cakes are built up uniformly on horizontal plates. High flow rates, easy cleaning, complete portability, extremely low maintenance and operating costs, and minimum "down-time" — are other Sparkler features "tailor-made" for the plating industry.

Contact your Sparkler representative today, or write Mr. Eric Anderson for full information or engineering assistance.

SPARKLER MANUFACTURING COMPANY, Mundelein, Illinois

Sparkler International Corp.
Overtoomsche Straat 555, Amsterdam, Holland

Sparkler Filters Hamilton Corp.
Hamilton, Ill., U.S.A.

Trade Literature

trifugal pumps; carbon or graphite structural shapes, brick and cement, motor and generator brushes.

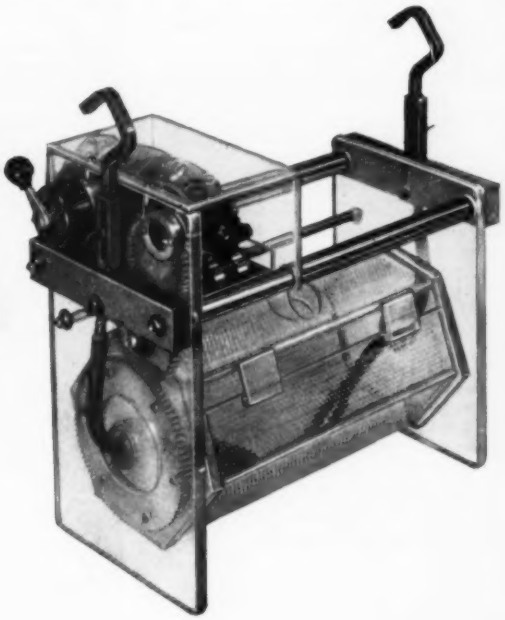
Information is given on sizes and physical characteristics of each product, in addition to many useful tables, such as Typical Physical Properties of Carbon and Graphite Products; Corrosion Resistance of "Karbate" Products; Heat Conductivity of Various Materials; Performance Curves of "Karbate" Pumps; Permeability of Porous Carbon and Graphite. For your copy, use Reader Service Card.

I—743. Removal of Buffing Compounds from Metals—In a paper, "Removal of Stearic Acid from Surfaces by Alkaline Detergents", J. Fred Hazel and William Stericker of Philadelphia Quartz Company, Public Ledger Bldg., Philadelphia 6, Pa., have indicated that too high a concentration of an alkaline cleaner in removing stearic acid from zinc did not give as good results as an intermediate concentration. It was determined that the sodium stearate salted out on the work and lost in solubility under highly alkaline conditions. The thin film thus formed prevented further cleaning. Many a plater has found that the work has not been improved by throwing in several more pounds of cleaner, and in fact has often become worse. The cleaners used in the tests were sodium hydroxide, trisodium phosphate, sodium carbonate and several types of sodium silicate. For reprints of the article, use Reader Service Card.

I—744. Vacuum Metallizing and Pumping, Water Stills—The F. J. Stokes Machine Company, 5500 Tabor Rd., Philadelphia 20, Pa., has published a Catalog No. 715, "Complete Vacuum Processing Systems". The 12-page catalog describes, pictures and gives complete specification tables for many types of vacuum equipment. For your copy, use Reader Service Card.

I—745. Lining and Coating Material—Carboline Company, 7603 Forsyth Blvd., St. Louis 5, Mo., after a year of plant and laboratory tests, offers Phenoline No. 300, a 100 per cent unpolymerized resin fluid free from solvents. It is said to polymerize at room temperature in one day or less to form a coating that bonds directly to almost any surface and that resists almost all solvents (including ketones), most concentrated acids at room temperature, most dilute acids at high temperature and up to 70 per cent caustic soda up to at least 85° C.

Uses include lining of tanks, fans, ducts, pipe and pumps; coating of agitators and fan blades; painting of structural steel and process equipment; "acid-proofing" of concrete floors, troughs, ducts and



OUTSTANDING

STUTZ—*the* "Original" *Lucite Ribless Portable Plating Barrel*—

Revolves through the entire plating cycle without transfer of load from one cylinder to another. Maximum solution temperature 185° F. Made in two sizes:

6" x 12" $203.50
8" x 18" $302.50

With reversing switch and plug-in cord and with standard perforations of 3/32" or larger.

Small perforations
$8.00 to $28.00 extra.

As Lucite is non-absorbent, one unit can be used for all your solutions. ORDER TODAY—this is the best investment you can make for your plating room.

Don't Delay—
ORDER TODAY!
STUTZ—
Your Guarantee of Quality!

GEORGE A. STUTZ MFG. CO.
PEERLESS PRODUCTS
1645 CARROLL AVENUE CHICAGO 12, ILL.

Trade Literature

sumps, and repairing of tank leaks. For your copy of a 4-page descriptive Bulletin No. 600, use Reader Service Card.

L—746. Facilities for Custom Grinding and Polishing—These facilities for stainless steel and other sheet metals are described in a folder available from American Nickeloid Company, Peru, Ill. It gives in detail the firm's capacities for producing a surface ground to any desired degree of roughness or high polish on sheets up to 60 x 144 inches. Sheets of monel, solid nickel, brass, copper, zinc, carbon steel and stainless steel in a wide range of gages can be ground on one or two sides.

Manufacturers interested in avoiding the heavy investment of maintaining their own grinding and polishing departments are invited to use the Reader Service Card for their copy.

L—747. Water Demineralizer—Penfield Manufacturing Co., Inc., 19 High School Ave., Meriden, Conn., has published a catalog sheet with a description of its new Mono-Bed Demineralizer. Included are a picture of the unit, a diagram with parts lettered and identified, a description of the parts, a specifications chart, and a performance chart from which potential users can estimate their operating costs. This unit is available in flow rates from 10 to 10,000 gph. The national average chemical costs for its operation is said to be less than 15c per 1,000 gallons. For your copy, use Reader Service Card.

L—748. Abrasive Blast Cleaning—The Pangborn Corporation, Hagerstown, Md., announces a 4-page, 2-color Bulletin No. 222 on its Airless Rotoblast Room, a completely enclosed chamber in which large castings are cleaned by streams of centrifugally hurled abrasives.

The illustrated bulletin explains how the Room reduces cleaning time by two-thirds, cuts labor costs, improves cleaning quality, and makes the operator's job easier. (Previously the airless blast-cleaning techniques was confined to small castings.) It also tells how the Room operates and how all exposed casting surfaces are thoroughly cleaned. Information on abrasive reclamation and safety is also included, and features are described and illustrated. A specification page gives front, plan, and side drawings plus other data. For your copy, use Reader Service Card.

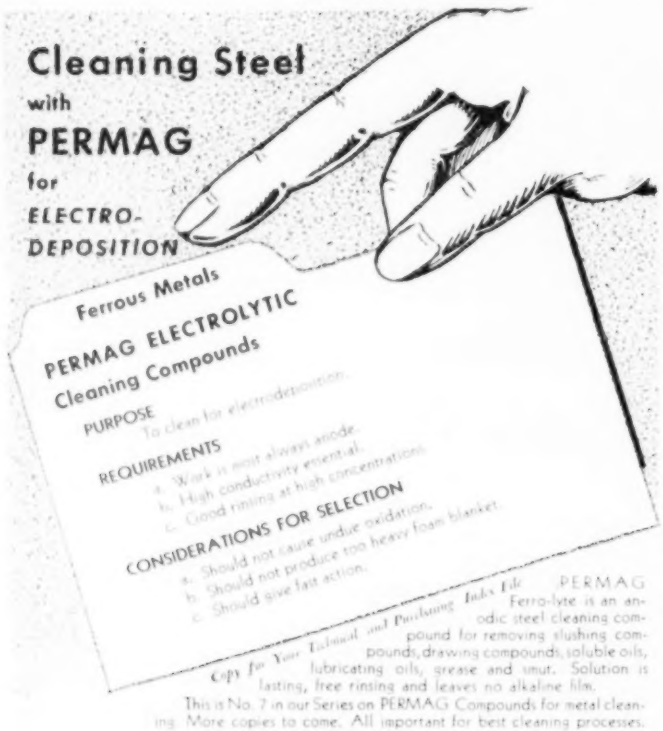
L—749. Chemical Resisting Work Clothes—Bulletin No. CF-28, issued by Mine Safety Appliances Company, Braddock, Thomas and Meade Sts., Pittsburgh 8, Pa., describes work clothes made of Dynel fabric and their construction.

Called MSA ChemKlos, they are said to resist acids, caustics, wear, moths, mildew, shrinkage, snagging and tearing.

The high replacement cost of ordinary work clothes that are eaten away or damaged after comparatively short service can be substantially reduced by the use of these clothes, it is said. Available in shirts, trousers and coveralls, comfortable and neat-appearing they are claimed to be easily cleaned and not harmed by commercial dry-cleaning and washing solvents in concentrations hard on ordinary fabrics. For your copy, use Reader Service Card.

L—750. "A Basic Training Manual on Statistical Quality Control" is the title of a book by Rudolph Freedman and Joseph Moyshin, written in cooperation with the Industrial Engineering Department of Washington University and published by the St. Louis Society for Quality Control, 6651 Kingsbury, St. Louis 5, Mo.

This manual has been written for use in short elementary courses in statistical quality control. It may be used for plant training and short courses that are often given by technical societies. It may also be used as a laboratory manual in conjunction with a standard text on quality control in a full course.


Cleaning Steel
with
PERMAG
for
ELECTRO-
DEPOSITION
Ferrous Metals
PERMAG ELECTROLYTIC
Cleaning Compounds
PURPOSE
To clean for electrodeposition.
REQUIREMENTS
a. Work is most always anode.
b. High conductivity essential.
c. Good rinsing at high concentrations.
CONSIDERATIONS FOR SELECTION
a. Should not cause undue oxidation.
b. Should not produce too heavy foam blanket.
c. Should give fast action.
Copy for Your Technical and Purchasing Data File
PERMAG Ferro-lyte is an anodic steel cleaning compound for removing slushing compounds, drawing compounds, soluble oils, lubricating oils, grease and smut. Solution is lasting, free rinsing and leaves no alkaline film.

This is No. 7 in our Series on PERMAG Compounds for metal cleaning. More copies to come. All important for best cleaning processes.

MAGNUSON PRODUCTS CORPORATION

Mfrs. Specialized Cleaning Compounds for Industry

50 Court Street - - - - - BROOKLYN 2, N. Y.

In Canada: Canadian PERMAG Products, Ltd. Montreal

Now you can *specify free fatty acid content to ½%* ... and get it!

If you use imported palm oil in rolling operations, probably one of your biggest headaches is the wide spread from batch to batch in free fatty acid content, often as much as 10%.

With too high an acid content both your emulsion and your cleaner formulas may be thrown out of balance. And of course *any* wide variation from specifications can play hob with uniform performance and production control.

With Palmoshield, new all-American replacement for palm oil, you get the acid content you specify within ½% (± ¼%).

Since Palmoshield is a scientific product, man-made from domestic materials, it is subject to exact chemical control. You can specify your preferred free fatty acid content on delivery, and you are assured this percentage will not change under normal storage.

Equally important in these uncertain times is the fact that Palmoshield is an all-American product made from freely available domestic materials. Users are not dependent on overseas shipment from foreign-controlled sources. A call to Ironsides in centrally located Columbus brings immediate shipment.

Palmoshield has been under test for three years in cold rolling steel production under standard operating conditions. Results show that the new lubricant duplicates the chemical characteristics of the imported product and that it is in certain ways superior.

Palmoshield is already in successful use in several leading rolling mills. It is available for immediate shipment in 55-gallon drums and in tank car lots. Competitively priced. For full details call or write The Ironsides Company, 270 West Mound Street, Columbus, Ohio.

SPECIAL LUBRICANTS *and* PRESERVATIVES

SHIELD PRODUCTS

IRONSIDES
PALMOSHIELD

Trade Literature

The manual consists of a brief text which serves as a set of notes for the students. The heart of the manual is a series of work sheets covering frequency distributions, $\bar{X}$ & R charts, p charts, pn charts, c charts and sampling.

The price of a single copy is $2.50. In quantities of 10 or more, the price is $2.00 per copy, and an instructor's guide is available upon request at no extra charge with each order of 10 or more copies.

L—751. Chromium Plating Technique and Applications—Subscriptions to a new book, "Chromage, Technique et Applications" by P. Morisset are now being sought by the publishers, Centre d'Information du Chrome Dur, Grand Palais, Porte C, Paris 8, France. The price is 3,800 French francs; the publication date, early in 1952. The book will be divided into four parts: I. Theory of Electrolysis; II. Technique of Chromium Plating (including preparation of the surface, bath composition and operating conditions, dehydrogenizing of the deposit, stripping, arrangement of anodes, different types of chromium plating); III. Properties of Chromium Deposits; IV. Industrial Applications (especially applications of "hard" chromium). For application forms, write to Centre d'Information du Chrome Dur.

L—752. Special Plating Processes—The Hanson-Van Winkle-Munning Company, Matawan, N. J., offers to the plating industry a new and revised condensed description of special H-VW-M Electroplating Processes. Bright-plate, high-speed processes are described for the electroplating of cadmium, zinc, copper, nickel, and silver, along with information on improved methods for lead plating. For those interested in any particular process, there are technical manuals illustrating and describing the various processes in detailed form. For your copy, use Reader Service Card.

L—753. Thickness Tester for Metallic Coatings—Kocour Company, 4800 S. St. Louis Ave., Chicago 32, Ill., offers an Electronic Thickness Tester for determination of thickness of chromium, silver, tin, cadmium, zinc, brass, copper and nickel deposits of any thickness from 0.00005 inch (0.000005 for chromium) within 5–10 per cent. The instrument strips the plate from a 0.125-inch diameter area in about 1 minute, shuts off automatically, and permits a direct reading of the thickness. For your copy of a descriptive bulletin, use Reader Service Card.

L—754. Grinding, Polishing, Buffing Equipment—Hammond Machinery Builders, Inc., 1613 Douglas Ave., Kalamazoo, Mich., have released an informative 20-page catalog covering their complete line of abrasive-belt and wheel grinding, polishing and buffing machinery. The new Catalog No. 75 describes their bench- and floor-type wheel grinders, and polishing lathes and backstands of various sizes and capacities for abrasive-belt applications. Needed accessories for buffing and polishing operations are also featured. Complete information and specifications on the Hammond cyclone- and filter-type Duskolectors complete the catalog. For your copy, use Reader Service Card.

L—755. Acid Resistant Brick Floors—Bulletin AB17, on "How to Build Corrosion Resistant Floors" has been issued by The U. S. Stoneware Company, Akron 9, Ohio. It describes the uses of acid brick and of different types of cement, and shows detailed drawings of various types of floors as well as actual installation photos. Complete installation instructions and answers to typical questions on flooring are covered in this new 16-page 2-color bulletin. For your copy, use Reader Service Card.

L—756. Lead-Clad Copper Anodes, Coils—Knapp Mills, Inc., 23-15 Borden Ave., Long Island City, N. Y., offers a 22-page illustrated booklet on Ferrolum and Cupralum, lead-clad steel and copper.

The Electro-Cupralum anode consists of a copper core to which is bonded a lead cladding. Such anodes, with up to 10 times the conductivity of straight lead anodes, are said to be especially useful in hard-chromium plating. Freon-cooled lead-clad copper coils with their high heat-transfer coefficient are used for cooling of sulfuric acid. For your copy, use Reader Service Card.

STOP OFF

FOR

ALUMINUM

A new Stop Off lacquer for use on Aluminum in selective anodizing, or in chemical treatments of this metal.

BUNATOL No. 796-CC Black is a quick air dry liquid that flows out easy and covers well. Air dries in 30 minutes to form a very adherent coating that is not affected by anodizing solutions or chemical solutions. Edges may be trimmed to a hair line, or lettering or designs may be exposed, and hold the edge perfectly. Applied by brush, spray or dip.

A single coat is all that is required for a good Stop Off film. This special lacquer covers a lot of surface, making it an inexpensive item to use in production. After running, the coating removes easily with a quick wash in Solvent. The Aluminum does not need any preliminary treatment other than removing surface dirt and grease, and must be dry. Just apply Stop Off, air dry and run the work.

No. 796-CC Black is made for use on Aluminum and of course does a better job. Time is saved—rejects eliminated and cost reduced. If your anodizing requires stopping off, get the facts about BUNATOL and a working sample. A note on your letterhead is all that is necessary.

BUNATOL

Manufactured by

NELSON J. QUINN COMPANY

TOLEDO 7, OHIO

Equipment and Supplies

E—827. Bright Silver Plating—Hanson-Van Winkle-Munning Company, Matawan, N. J., announces a silver plating process which is said to make it possible to obtain bright silver plate without buffing or scratch brushing. In addition, this

Spoon on right was plated by new Silver-Lume bright silver plating process, the other by conventional silver plating method. Both appear exactly as taken from plating tanks

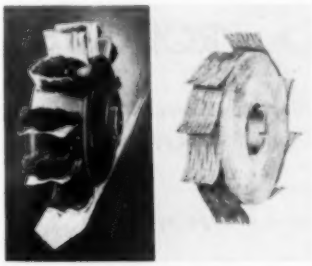
Silver-Lume process is said to produce a noticeably more tarnish-resistant surface, have a wide bright range, require no special equipment, produce excellent deposit distribution and uniform color, be easily controlled, and be low in cost.

A new bath is prepared from silver cyanide, potassium cyanide and potassium carbonate with small amounts of Silver-Lume Brighteners A and B. The potassium salt solution is preferred over sodium salts, as the latter has a much narrower bright range. Existing solutions can, in most cases, be converted, sometimes with activated-carbon treatment to remove impurities, sometimes with electrolysis for several days.

The process is said to be operated over a wide range of current densities and to give fully bright deposits at current densities up to 55 asf at 70–120° F, compared to 5-10 asf in conventional solutions. Users report freedom from operating difficulties.

The Hanson-Van Winkle-Munning laboratory is fully equipped to process sample articles prepared as for regular silver plating. For further information, use Reader Service Card.

E—828. Scored Abrasives Cloth—Merit Products, Inc., Culver City, Calif., is now supplying "scored" abrasive refill cartridges for use in its line of Sand-O-Flex brush-backed contour sanders. The illustration on the right shows the cloth cut in staggered rows to give it pliability, that on the left shows it gets down into grooves and recesses with a "paint brush" action. Cartridges are available in garnet



and aluminum oxide cloth in a wide range of grits. For further information, use Reader Service Card.

E—829. Reconditioning Valves and Fittings—The reconditioning of valves and fittings is an important part of the maintenance program in many plants. Magnus Chemical Company, South Ave., Garwood, N. J., recommends for the removal of deposits of oil, paint, lacquer, carbon, as well as stubborn lacquer-like or coke-like carbonized oil deposits, a heavy duty alkaline cleaner containing 8 oz/gal Magnus 61RS, kept at a rolling boil, for 0.5–1 hour.

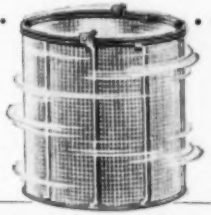
Scaly valves, etc., are then soaked in an 8 oz/gal solution of D-Scale-R heated to 130° F, for about 30 minutes or until the deposit is dissolved. The parts are then rinsed, given a brief dip in the 61RS solution to neutralize any residual acid, and finally rinsed with water.

Valves and fittings with carbonized oil deposits are first treated for 15 minutes with Magnus 751, a carbonized oil solvent, at room temperature.

PAYS FOR ITSELF... IN TIME SAVED

Kreider Dryer with auxiliary steam heating unit (illustrated). Auxiliary natural gas heating unit available; also standard model without auxiliary heating.

Basket (below). Heavy gauge woven steel mesh over steel frame. Capacity, 1140 cu. ins.



Spin-Dries* up to 50 pounds in less than 2 minutes

Saves drying time. Kreider Dryer operates on ¾ h.p. at 625 r.p.m. . . . cuts drying time to as little as 35 secs.—no more than 2 mins.—for each 50 lbs.

Saves production time. Runs at top speed with maximum load, hour after hour, day after day. Ends drying "bottle necks". . . assures smooth, evenly dried surfaces, longer lasting lustre—fewer "rejects."

Saves maintenance time. Simple, sturdy construction reduces "time-outs" for repairs and servicing to a minimum. Assures long life.

See for yourself! Write Department PL-5230 today for illustrated 4-page folder . . . also addresses of installations near you.

New Holland Machine Co., New Holland, Pa.

***Only 2 simple steps required...**

(1) Operator places wire mesh basketful of small parts in Dryer . . . turns motor "ON."

(2) Operator turns motor "OFF" . . . presses foot brake . . . removes basket.

NEW HOLLAND KREIDER DRYER

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 331.

For Quality and Uniformity
Specify

HARRISON 4A PRODUCTS

Stainless Steel Buffing & Polishing Compounds
Faster Cutting—Increased Production—Economy

Glazing Compounds
Compounds for Spraying or Dipping

Use 4A Cement and Thinner—For Setting Up Wheels, Belts, Rolls, etc.—Longer Life—Greater Production

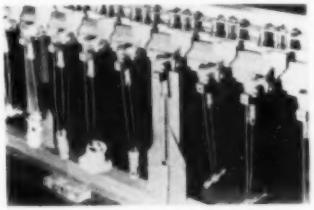
Consult Us On Any of Your Problems
We'll Gladly Advise and Send Samples

HARRISON CO., INC.
HAVERHILL, MASS.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 332.

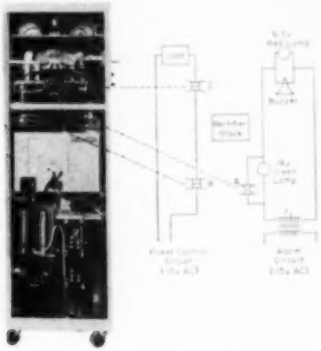
None of the cleaners is harmful to steel, stainless steel, cast iron, brass or bronze, and cleaning effectiveness is the same in most cases, it is said. For further information, use Reader Service Card.

E—830. Colloidal Graphite for Plating Machine Lubrication—Shown here are contact shoes on an automatic plating machine made by Lasalco, Inc., St. Louis, Mo. "Dag" colloidal graphite pro-



duced by Acheson Colloids Corporation, Port Huron, Mich., is applied to the shoes to create a dry lubricating and conducting film. It is especially effective because in addition to being a good solid lubricant it has excellent electrical conductivity. For further information, use Reader Service Card.

E—831. Thermoswitch Protection for Rectifiers—Excessive heat is a hazard in selenium rectifiers because it can damage or destroy the selenium layer on the rectifier plates that comprise the stack. In some types of rectifiers, the selenium layer is protected by a current-limiting



system; other rectifier units incorporate a device that cuts off the power if the air supply fails. According to W. Green Electric Company, 130 Cedar St., New York 6, N. Y., the key to maximum rectifier efficiency and plate protection is a device that can quickly sense and respond to the temperature of the stack.

In the fan-cooled Green rectifiers, peak-load efficiency is said to be maintained with safety by the action of a set of Thermoswitch units manufactured by Fenwal Inc., Ashland, Mass., mounted around the rectifier stack. The Thermoswitch was

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selected because of its inherently high sensitivity (± 0.1° F). If, for any reason, the stack temperature exceeds approximately 163° F, the "A" switch contacts close and actuate the alarm system, a warning buzzer, a red light, and the shorting-out of the green, "safe-operation" light. If the required operating adjustments are not made and the stack temperature rises to 167° F, the contacts of the "B" switch open and operate the automatic power-control system which cuts off the power. The time lag enables attendant to make the necessary adjustments before the power cuts off, thereby preventing poor plate and stripping. If the fan fails, or the air supply is blocked, the hot convection currents rising from the plates actuate the "C" switch at 130° F, and the power is immediately cut off. For further information, use Reader Service Card.

E—832. Blackening of Ferrous Metals.—A two-bath method for blackening all ferrous alloys, malleable and cast irons and carbon steels is said to have been perfected by the Swift Industrial Chemical Company, Canton, Conn. Swift Nu-

Black, as it is called, is reported to be effective, over a wide temperature range, in creating a black surface of uniform density without bringing about any dimensional change. The operational efficiency is attributed to the use of several activating agents. For further information, use Reader Service Card.

E—833. Radioactive Tracer Techniques—The six basic fields in which radioactive materials may be used in the solution of industrial problems are outlined in the November issue of "Tracerlog" the house organ of Tracerlab, Inc., 130 High St., Boston, Mass.

E—834. Coloring Aluminum—A new chemical process that in one operation permits the protection and coloring of aluminum in such colors as yellow, blue, green, gold, brass and many others is announced by Enthone, Inc., Dept. P., 442 Elm St., New Haven, Conn.

Called Alumox 44, it consists of cleaning the aluminum part and then immersing it in a solution of Alumox 44 salts. Dyes can be added to the processing solution so that coating and dyeing occur simultaneously, or dyeing can be done separately. It is claimed that aluminum objects can be dyed shades of brass and gold to resemble the solid metals, a matter of importance in view of the shortage of copper-base alloys, and that Alumox 44 is equally effective on bulk work and on large objects. Almost all aluminum alloys can be processed successfully, including the wrought and the cast alloys.

The clear coatings reduce finger marking and protect the aluminum against weathering, are relatively nonductive, and have a thickness of approximately 0.0001 inch, but are not meant to be substitutes for electroanodizing. In most cases, the finish is covered with clear lacquer.

Objects that have been very successfully colored include aluminum hardware, jewelry, slide fasteners, buttons, nameplates, automobile trim, goblets, picture frames, bead chain, medallions, electrical fittings, lamps and pencil parts.

The Alumox 44 salts are added to water in a concentration of 1 lb/gal. The bath operates at 190–210° F. Coloring is accomplished in from 15 seconds to 2 minutes. A recommended list of dyes is given to the customer. For further information, use Reader Service Card.

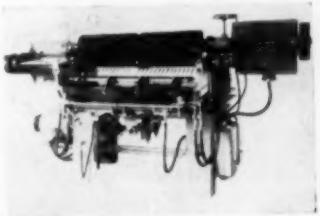
E—835. Laboratory Rectifier—Convenience as well as simplicity and dependability is claimed by R. O. Hull & Company, Inc., 1305 Parsons Court, Rocky River 16, Ohio, for its New Robco Comet Rectifier, designed for Hull Cell control or other small-scale plating operations. The specifications of interest to platers are: Input: 110-volt, 60-cycle single-phase ac; output: 0–6 amp at 0–18 volts, 0–30 amp at 0–15 volts; ammeter; dual-range, 0–6, 0–30 amp; voltmeter: single-range, 0–20 volts; stepless voltage control: 0–full load; interval timer: 0–5 minutes with manual stop, may be switched in or out of circuit; dual convenience outlets; for 110-volt accessories. For further information, use Reader Service Card.

E—836. Aluminum Etching—A new compound for the controlled etching of aluminum and its alloys has been developed by the Silver Star Chemical Corporation, 58 Watts St., New York 13, N. Y. This Star Etch is said to eliminate foaming, sludging, and hard-scale formation on tanks and heating coils while sharply reducing the hazards associated with conventional etching. Either dipping or mechanical spraying may be used. The bath is easy to operate and maintain, and appreciable savings in labor, maintenance and heating costs may be realized, according to the manufacturer. For further information, use Reader Service Card.

E—837. Wet Blaster—The Cro-Plate Company, Inc., 747 Windsor St., Hartford 5, Conn., announces the newly redesigned "Pressure-Blast, Jr", a bench-model wet-blasting unit in which the usual troublesome pump has been replaced with a compressed-air-operated jet gun.

Used for deburring, descaling and general surface cleaning, the unit is easily installed, requiring only a 3/8-inch water connection, a 3/8-inch air connection (standard shop pressure) and a single-phase 110-volt line for blower operation and lighting. Of stainless-steel construction with sweat copper plumbing, the new model uses any abrasive from 75 to 5000 mesh. For further information, use Reader Service Card.

E—838. Finishing Machine—The Clair Model 208 Surface Finishing Machine is designed to eliminate operations in the surface finishing of spoon handles, fork handles and similarly shaped products. Although developed for silverware through cooperation between Clair Manufacturing Company, 1016 S. Union St., Olean, N. Y., and several large silverware manufacturers, the machine is also recommended for finishing of plier handles, surgical instruments, carving forks and many other curved items.



Before the development of this machine, the practice was to finish the spoon bowls on the Model 204 Spoon and Form Machine, remove the spoons from the racks and place them in tote boxes, then either hand finish or reload them in another rack for finishing of the handles on another machine. According to the manufacturer, the Model 208 Machine, which allows batches of work to be transferred as units

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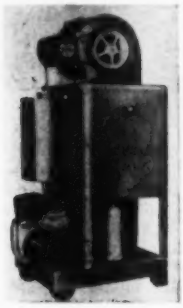
from one holding rack to another between operations, speeds production and reduces the number of rejects caused by mars and scratches.

Operated by 7½- or 10-hp motors, the machine has an automatic hydraulic "in" and "out" stroke which is adjustable from 3/4 to 24 inches. An air circuit provides automatic float of buffs at any predetermined uniform pressure. A safety bar across the front controls instantaneous opening of the rolls during loading or as an emergency measure. Among optional features are controls which open rolls and arrest all actuation at the completion of any predetermined number of strokes from 1 to 400. For further information, use Reader Service Card.

E—839. Heat Machine—A 140,000-Btu heat machine for indoor or outdoor use is announced by Fageol Heat Machine Company, 5725 Mt. Elliot Ave., Detroit 11, Mich.



Known as the Fageol Model PW-140, the machine is reputed to blow warm air along the floor, creating a 6-foot-high heat blanket that eliminates the necessity for heating vast overhead areas in order to keep workers comfortably warm and is said to reduce heating costs by as much as 90 per cent.

Spraying heated air from all sides, it can be advantageously located in the center of large areas. The Model PW-140 is designed to heat workers comfortably in areas up to 3,000 square feet of confined space or 1,600 square feet of open space. A 200,000-Btu Model PW-200 is also available.

The machines burn regular furnace fuel oil of No. 3 or lighter grades or kerosene. Model PW-140 requires no flue or chimney. Self-contained, it has an attached 6-gallon fuel tank and is equipped with wheels for easy portability. Its dimensions are 21 x 33 x 58 inches, and it weighs 245 lb. It can be started or stopped by simply snapping a switch. For further information, use Reader Service Card.

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E—840. Aluminum Surface Treatment—Starcote, a surface conversion treatment for aluminum and its alloys developed by the Silver Star Chemical Corporation, 58 Watts St., New York 13, N. Y., is said to afford superior corrosion resistance and perfect organic-coating adhesion.

The bath is maintained by a simple titration. Work may be treated, in iron containers or racked, by dipping or by a conventional alkaline washing machine on a production-line basis. For purposes of identification the coating may be colored with certain dyes. For further information, use Reader Service Card.

E—841. Phosphate Bond—Du-Lite Chemical Corp., Middletown, Conn., has developed Phospray, a patented cold-spray bonding solution which can be applied with ordinary spray equipment. Phospray is said to eliminate such preparatory steps as cleaning, rinsing and drying. It is simply sprayed on the product where it dries immediately, ready for application of the final finish. It can be used on all metals except aluminum, and can be cut as high as three parts thinner to one part Phospray without reduction of its effectiveness. Phospray is said to have been thoroughly tested to government specifications, withstanding conditions of humidity, salt spray, etc., while furnishing the bond for a coating of paint. For further information, use Reader Service Card.

E—842. Polyethylene Exhaust Systems—Exhaust systems for corrosive vapors and fumes, fabricated throughout from polyethylene, are offered by the American Agile Corporation, P. O. Box 168, Bedford, Ohio. These installations, including tanks or tank liners, exhaust hoods, fume ducts and fume stacks, or any part thereof are built to customer's specifications.

Polyethylene exhaust and duct systems offer outstanding corrosion resistance against most acid fumes, including hydrochloric, hydrofluoric, sulfuric, and nitric acids. They are said to be easy to clean, to outlive most construction materials when used between −20°F and 170° F, and to be extremely economical, requiring no such upkeep as relining or repainting. For further information, use Reader Service Card.

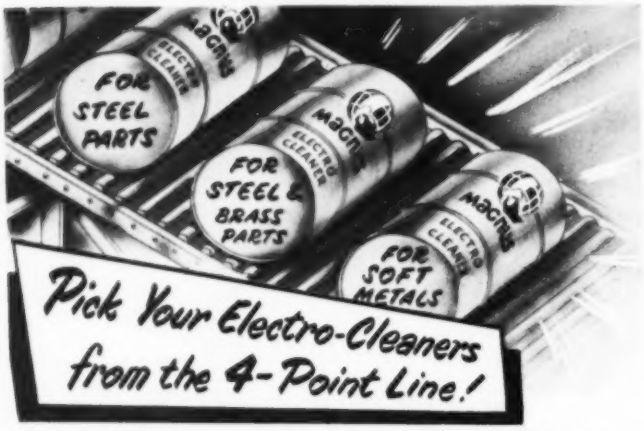
E—843. Vinyl Plastisol Coated Gloves—Hyflex Gloves, a new line of plastic-coated canvas gloves which will protect against water, acids, alkaline materials, oils and a variety of other corrosive chemicals, have been placed on the market by

Houghton Laboratories, Inc., Dept. 3A, Olean, N. Y. Applied by a centrifugal process, the tough, abrasion-resistant vinyl plastisol is said to have exceptional adhesion and freedom from pinholes.

The gloves are flexible enough for use in delicate chemical laboratory work and sturdy enough to stand up in severe production applications, including electroplating operations, according to the manufacturer. For further information, use Reader Service Card.

E—844. Hard Finishes for Aluminum—New hard anodic coatings on aluminum, for use where high resistance to abrasion or erosion is desired, are being released to licensees by the Aluminum Company of America. They have been used extensively in aircraft equipment and orthopedic appliances.

Alcoa has also acquired the U. S. patent rights to the Martin Hard Coating for aluminum from the Glenn L. Martin Company of Baltimore. The MHC finish is similar to the Alumilite coatings in hardness and structure. MHC-finished aluminum has been applied to many parts of Martin aircraft, such as pistons, cylinders, jack-screws, walkways, and door mechanisms. Other reported applications include gears and pinions, turbine impeller blades, nozzles, the leading edges of high-speed airfoils, and leg braces for paraplegics. For further information, use Reader Service Card.



The electro-cleaning compound that works effectively on steel would irretrievably damage soft metal parts like zinc or aluminum. A material suitable for steel and brass combinations would not be satisfactory for all steel pieces.

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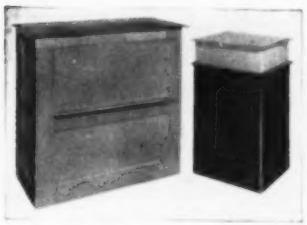
E—845. Plastic Sheet Fabricated Tanks—Polydur, an unplasticized (rigid) polyvinyl chloride plastic, is now available from Murray Products, Inc., 12400 Crossburn Ave., Cleveland 11, Ohio, in



fabricated tanks, hoods, vents, ducts, etc., as well as in miscellaneous industrial equipment for use where highly corrosive conditions prevail. Tanks are being made in two types: self-supporting, made from sheets ¼-1 inch thick; and wood, concrete or metal tanks with ⅛-inch liners.

The material is capable of resisting acids, alkalies, salts, oxidizing agents, oils, greases, alcohols, gasoline, carbon tetrachloride, etc., up to 170° F without dimensional deformation and without loss of chemical properties. Included in the corrosive materials to which Polydur is resistant are such items as acetic acid, concentrated sulfuric acid, ammonium nitrate, and other strong oxidizing agents. For further information, use Reader Service Card.

E—846. "No-Prep" Vinyl Primer—The U. S. Stoneware Company, Akron, Ohio, has announced a new vinyl primer, Tygorust, specifically developed for use on rusted steel surfaces without the necessity for previous preparation. It is said to be easily applied by brushing, spraying, or dipping; to dry hard and to take overcoating in a matter of minutes; to adhere tenaciously to rusted steel, damp or dry; and to be applicable with any type of finish coating, particularly vinyls. For best results, of course, the surface must be free of grease and oil and loose scale should be removed.

Tygorust can be applied to old, oxidized paint films (bituminous coatings excepted) without lifting or bleeding and be safely overcoated with vinyl, nitro-cellulose, alkyd and oil based finishes, according to the manufacturer. Previously rusted steel panels showed no evidence of rust creepage along the scorings after 120 hours of salt spray. For further information, use Reader Service Card.

E—847. Cleaner for Aluminum, Magnesium—"Aviation", said to be nonfoaming, noncorrosive, nonetching hot-tank cleaner that rinses quickly and completely with no tendency to bake on or leave a powdery residue, is the newest addition to the line of Turco Products, Inc., Terminal Annex 2649, Los Angeles 54, Calif.

The benefits of agitation can be realized with this nonfoaming cleaner: the soil-saturated solution is removed from the vicinity of the soiled metal, and the scrubbing effect aids in the removal of loosened soil. Any means for obtaining vigorous circulation can be used, it is claimed. Free of powdered residue, parts are immediately ready for further processing.

Aviation is said to meet the corrosion requirements of MIL-C-5543 and to remove, quickly, all types of foreign matter, even hard-to-remove etching-type mark-ink ink. Especially designed for use on reactive metals such as aluminum, magnesium and their alloys, it may also be used on many other metals. For further information, use Reader Service Card.

E—848. Rigid Polyvinyl Chloride Fabrications—Agilide, a rigid polyvinyl chloride said to exhibit exceptional resistance to water, acids, alkalies, salt solutions, oils, and many other corrosive media and to offer very good physical properties, is now fabricated through a combination of extrusion, molding, and plastic-welding processes according to customer's specifications by the American Agile Corporation, P. O. Box 168, Bedford, Ohio.

Fabrications range from tanks and tank liners, pipe and duct lines, exhaust hoods and ventilators, to complete equipment previously made from high-grade steels and other expensive metals.

Agilide is nonflammable and is recommended where working temperatures do not exceed 170° F. For further information, use Reader Service Card.

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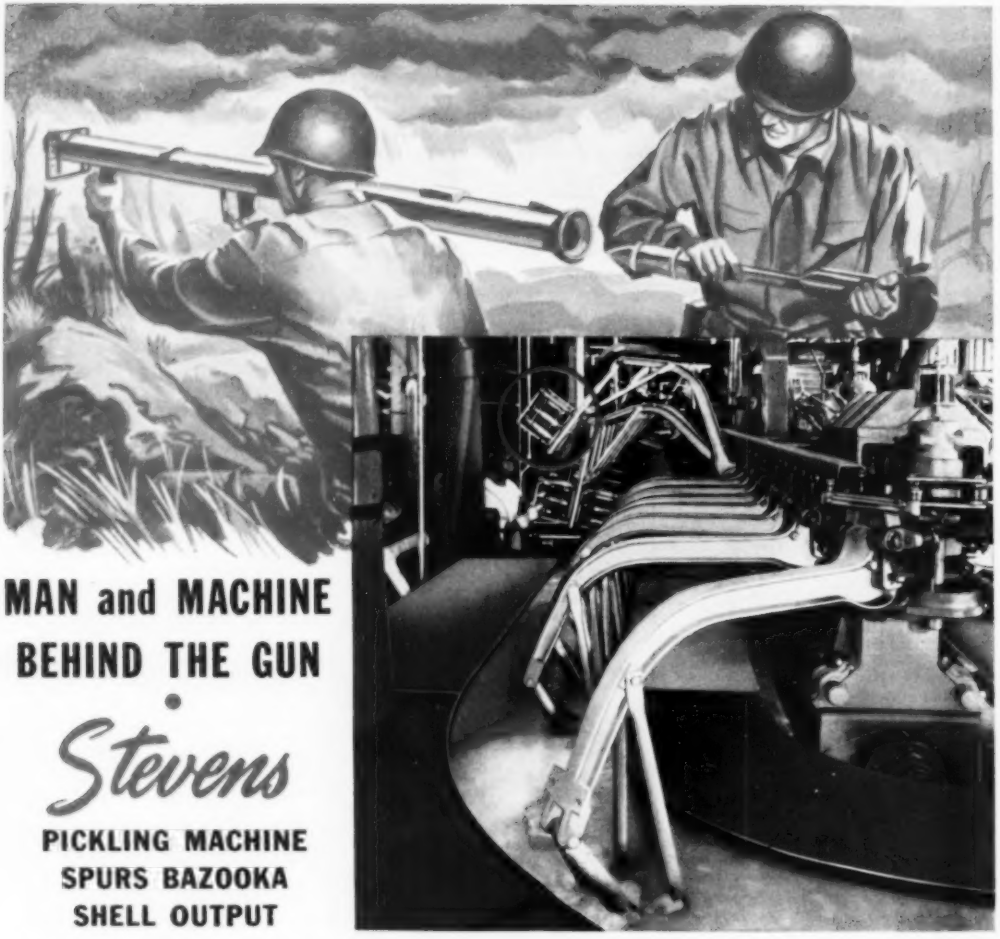

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The combat soldier's bazooka is his sling of David against the Goliath of enemy armor. If his first shot doesn't score, the gunner gets no second chance. So bazooka rockets must be as nearly flawless as man and machine can make them.

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MARCH, 1952 VOL. 39, NO. 3

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This month's cover picture shows the new anodizing plant of the Texas Engineering and Manufacturing Company, Dallas, Texas, described in the Industry News Section on page 218.

Published by the American Electroplaters' Society at 5800 N. Marvine Street, Philadelphia 41, Pa. Editorial, Advertising and Executive Offices: 473 York Road, Jenkintown, Pa. Phone: Ogontz 9650-1. Subscriptions: Domestic and Canada, $4.00 for 1 year, $7.00 for 2 years; 50c per copy; Foreign, $8.00 per year; $1.00 per copy.

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Editorial

Sheep Not of this Fold

THE PLATER when he is harassed by troubles often asks himself why he ever chose the plating industry for his life's work; certainly, in no other industry does one have such difficulties. To a certain extent he is right: The particular combination of requirements that pertain to electroplated coatings are not found in any other industry. Many of his problems, however, are encountered by the electrorefiners and electrowinners, who also do plating in the broadest sense of that word.

Many platers do not recognize how big the electrorefining and electrowinning industries are. Large portions of the copper, the high-purity zinc, the pure lead and the nickel, as well as many other metals, are produced by electrolytic means. Thus the total tonnage deposited by electrorefiners and electrowinners exceeds very greatly that deposited by electroplaters.

That the problems of the platers and of the electrorefiners are very similar was brought out at the two-day symposium on addition agents in extractive metallurgy held at the meeting of the American Institute of Mining and Metallurgical Engineers on February 20 and 21 in New York City.

Two points in particular impressed this writer. First, the refiner deposits on his cathode sheets what to the plater are exceedingly heavy coatings. And he does so under very unfavorable conditions. His anode-to-cathode distances are low, of the order of 1 inch, to the end that the cell voltage and thereby the all-important cost of current be held to a minimum. Even when soluble anodes of very high impurity content are used, as in most copper refining, the refiner cannot afford to make room for anode bags or diaphragms that would keep the sludge away from the cathodes. Nevertheless, the electrorefiner's heavy deposits are often very smooth and uniform. One contributing factor is the low cathode current density he employs, perhaps one-third of what a plater would use in the same solution for much thinner deposits.

Second, the refiner produces metal of very high purity. For that purpose he purifies his solutions by chemical and physical (absorptive) means which frequently differ from those of the electroplater. He also relies to some extent on his addition agents to shift the cathode potentials in a direction unfavorable to the codeposition of impurities. In this respect he is assisted by the absence of deep recesses on his cathodes, whereas the plater has to contend with preferential deposition of impurities in such areas. But unlike the plater, the refiner watches the cost of addition agents very carefully, and limits himself to the use of such low-cost materials as animal glue and wastes from the chemical industry.

The plater, especially if he deposits thick coatings, has learned from the electrotyper. He would also do well to include in his thinking some of the ideas of the electrorefiner and electrowinner, sheep of another fold of electrodeposition.

Gustaf Soderberg

WASTE TREATMENT LAYOUT FOR A JOB PLATING SHOP

A CASE HISTORY

LESLIE E. LANCY* AND H. F. HANSON†

THE PLATING SHOP in question is located in a rural area, with the waste water being discharged into a small creek, which in turn empties into a trout-fishing stream. It was required that all toxic materials be eliminated from the waste water before it was being discharged to the creek. It was also required that concentrated alkali cleaners and acid pickles be neutralized, precipitates settled and emulsified-oil contaminants removed before discharge.

The Original Installation

Fig. 1 shows schematically the original layout of the plating shop. It may be seen that the shop was set up for copper, nickel, chromium and brass plating. Production was scheduled for two daily 8-hr shifts with nine plating operators on each shift, excluding the supervisory workers and the racking-and-unracking laborers.

A survey of the flow rates and the concentration of toxic compounds in the waste gave the results shown in Table I, or approximately 11½ lb (5.3 kg) of chromic acid and more than 2½ lb (1.1 kg) of cyanide (CN) per hour.

TABLE I. WASTE FROM ORIGINAL INSTALLATION

Source	Flow gpm	Concentration ppm
1st rinse after chromium plating	10	1834 CrO_3
2nd rinse and hot rinse	10	485 CrO_3
1st rinse after high-speed copper plating	5	777 CN
1st rinse after diecast copper plating	3	358 CN
2nd rinses, hot rinses, rinse after brass plating	12	.....

The total flow of rinse waters, including the flow of rinses used after cleaners and acid dips, was approximately 80 gal/min (300 l/min).

It was evident from this analysis that an undue quantity of plating chemicals were wasted in this plant, no doubt to some extent owing to the type of work processed, but mainly because proper draining, efficient use of dragout rinses and similar time-consuming steps are considered too costly and unproductive with manual operation. Whenever waste treatment enters the picture one has to add to the cost of lost plating chemicals the cost of chemicals needed for the treatment. To treat the waste and eliminate such toxic compounds as cyanides and chromates, it is necessary to segregate the rinse waters into the types that will receive the same kind of treatment. With a layout such as the one shown on Fig. 1, where all rinse waters run on the floor towards a common sewer opening, the segregation and piping of the rinse waters becomes an expensive undertaking.

The New Installation

The first survey indicated that, unless changes were made in the layout, the waste treatment would be a financial burden on account of the large quantities of waste and the expense of laying a maze of drain lines. It was proposed, therefore, to modernize the whole plating shop and invest in automatic plating equipment. In that way extra drainage and dragout stations could be employed, the drainage canals could be laid out to accomplish the desired waste segregation and collection, and last but not least, the investment required would be productive and amortized from the savings achieved in direct labor costs.

An automatic plating unit for job-shop operation has to be planned in such a manner that it have maximum flexibility for all kinds of work scheduled through the plant. In this particular instance arrangement for inexpensive waste treatment was also a prerequisite.

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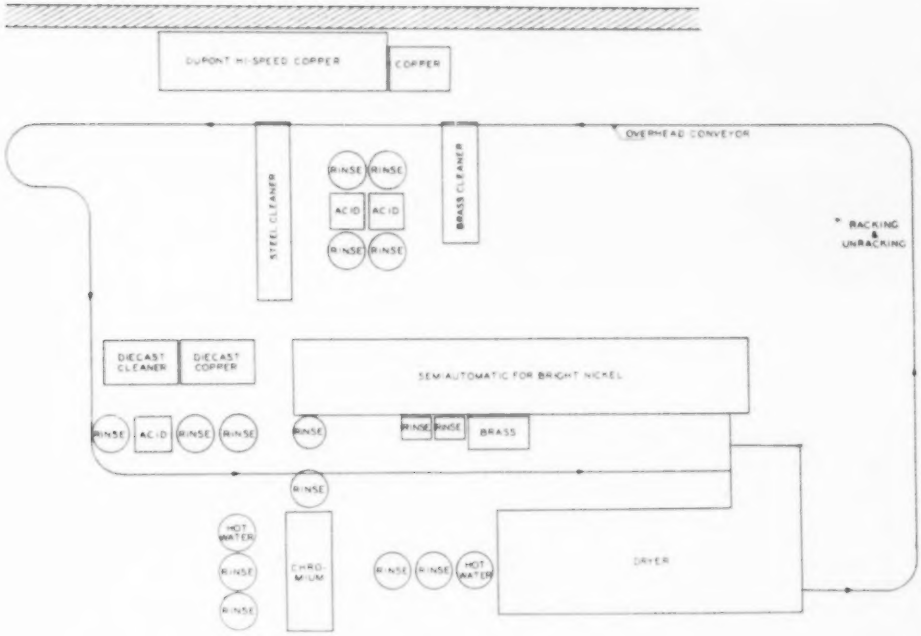

Fig. 1. Schematic diagram of original plating shop

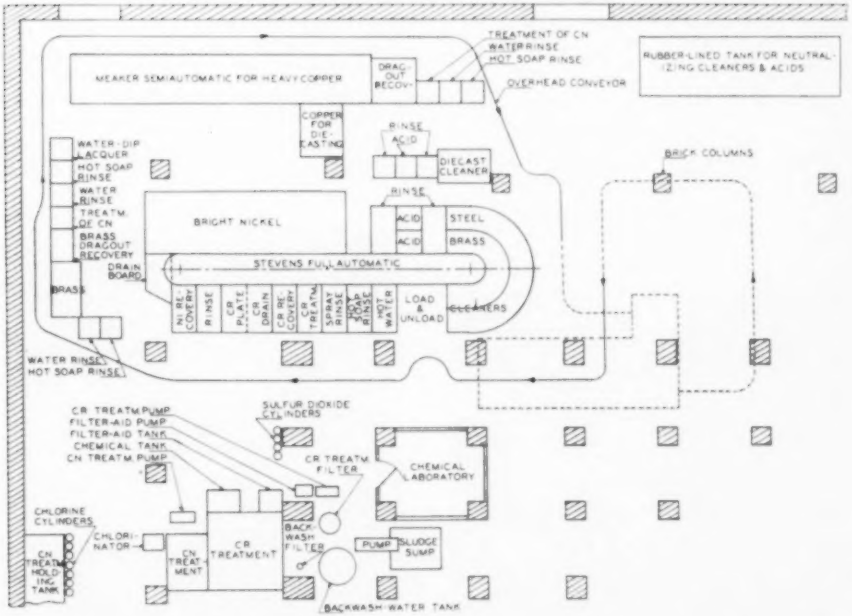

Fig. 2. Schematic diagram of the modernized layout, with dotted lines marking the monorail track as it goes through the drying oven and by the racking tables on the second floor

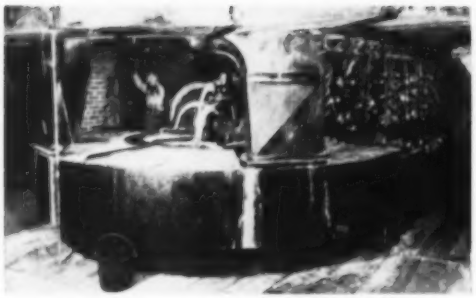

Fig. 3. Stevens automatic plater from the cleaning end. Transfer station to copper plating in right background

Fig. 2 shows the modernized plating plant laid out around a Stevens fullautomatic plating machine.

To make the changeover with the least loss of production time, the new plating plant was laid out and built on the first floor of the building while the old plating shop maintained operations on the second floor. It was necessary to excavate for the foundation of the automatic unit and for the drainage channels, because the ceiling height was too low. As a final result, useless floor space was salvaged, and the changeover was accomplished in five days of transfering plating solutions and of reconnecting generators and the rack-handling monorail system.

The automatic plater (Fig. 3) has divided cleaning and pickling facilities for most efficient separate cleaning of steel parts and cuprous work. At the first transfer station, cleaned steel work is removed for copper plating, cleaned, and returned—together with copper-struck diecast parts—to the bright-nickel plating step. Work not requiring copper, such as parts that have been previously copper plated and buffed, polished brass and steel parts, pass through this transfer station without being removed from the conveyor. The second transfer station follows the nickel plating step.

TABLE II. WASTE FROM NEW INSTALLATION BEFORE TREATMENT

Source	Flow gpm	Concentration ppm
Sewer canal for chromium waste	25	41.6 CrO_3
Sewer canal for cyanide waste	15	85 CN

Here the work to be brass flashed is taken off. The last transfer station is the main loading-and-unloading station.

Both nickel and chromium plating are followed by drainage and recovery wash stations to reduce the waste of plating chemicals and lower the consumption of chemicals in the waste-treatment step. Hot recovery rinses are installed also after the manual copper (Fig. 4) and brass (Fig. 5) plating tanks. These recovery measures proved even more effective than had been anticipated.

Although the production was quite heavy, averaging 400 racks per hour, and the parts were not suited for perfect drainage, the dragout carried by the work after the recovery rinses was materially reduced, as shown in Table II. The total chromic acid waste was about 0.5 lb (0.24 kg) CrO_3 and about 0.65 lb CN (0.29 kg) per hour.

An Integrated Waste Treatment

The waste treatment layout is based on the "integrated waste treatment" principle[1,2] by which the toxic waste is treated before it reaches the sewer. The rack and work carrying the toxic waste is washed with a solution containing the chemicals needed to render the

Fig. 4. Diecast cleaner and copper plating setups

Fig. 5. Brass plating line

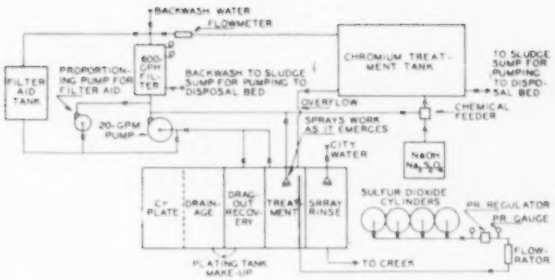

Fig. 6. Diagram of the chromium treatment system

waste harmless. The composition of this treatment wash is maintained, and it is constantly recirculated, to insure uniform composition and the removal of precipitated insoluble salts.

The treatment plant was laid out close to the plating line to utilize space broken up by numerous columns, which was useless for any other purpose. The proximity to the plating tanks was advantageous because the length of piping could be held to a minimum, and supervision was made easier. The treatment solutions are controlled with the processing and plating solutions in the plating line.

The Chromic Acid Treatment System

Fig. 6 shows a schematic diagram of the chromic acid-treatment system including the pertinent stations on the automatic plating machine. The treatment solution sprayed on the work contains sulfur dioxide to reduce the chromic acid to chromic salts and is kept at an alkaline *p*H to precipitate the chromic hydroxide. To counteract the fluctuations in the chromic acid dragin, and obtain an effluent of more constant composition, a large treatment-solution reservoir (Fig. 7) is used in conjunction with the treatment rinse. The treatment solution also contains a wetting agent to help it penetrate any broken rack linings, treed deposits on the racks, etc. Liquid caustic and sodium hydrosulfite are added through a small vacuum-type ejector to maintain the alkaline *p*H and to carry the reaction to completion. The sulfur dioxide gas is added through a diffuser right in the treatment rinse tank. A filter (Fig. 8) is connected in the recirculating line to filter out continuously the precipitated chromic hydroxide, and filter aid is used to keep the filter cake open. The filter is of sufficient capacity to operate for a week between backwashings. The filter cake and backwash waters are pumped to a sludge bed for drying and collection, the chromic salts being of sufficient purity to have commercial value. Thus the whole layout is extremely simple, inexpensive and economical to operate.

The treatment wash after chromium plating is also used to spray the rack hooks in order to eliminate all chromic acid contamination from the plating process. This feature helps to protect the alkali cleaners, contamination of which is very troublesome, especially in brass cleaning. Another desirable side effect is that the work becomes free from chromic acid stain. The inside of dished or formed work, even with the best ordinary rinsing, carries small quantities of chromic

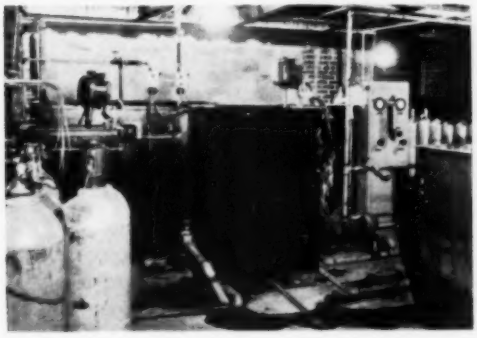

Fig. 7. Chromium and cyanide treatment reservoirs, with chlorinator and cyanide treatment holding tank in right background, sulfur dioxide bottles in front

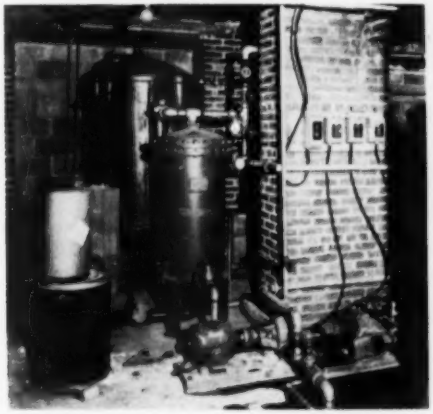

Fig. 8. Chromic hydroxide filter-and-backwash equipment

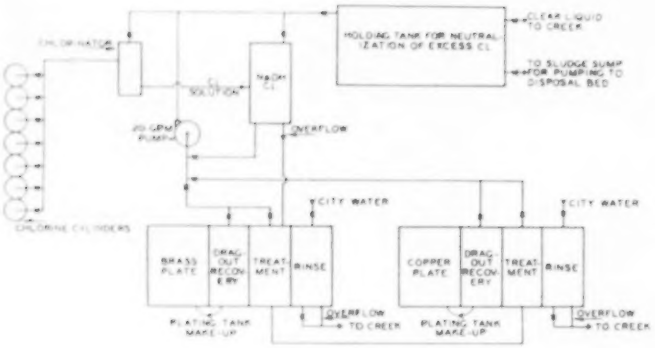

Fig. 9. Diagram of the cyanide treatment system

acid which seep out slowly and bake on in the drier.

The Cyanide Treatment System

Fig. 9 is a schematic diagram of the cyanide-treatment system. The treatment solution in the reservoir (Fig. 7), the treatment wash after copper plating and the treatment wash after brass plating are all interconnected in a recirculating system. Chlorine gas is fed through a chlorinator and a diffuser into the treatment-solution reservoir. The *p*H of the solution is maintained by the dragin; thus, alkali additions are not usually required. A nonfoaming penetrating-and-wetting agent is incorporated into the treatment solution. Inasmuch as it slowly builds up in soluble inorganic salts (sodium chloride, carbonate, etc.) the treatment solution is discarded once a month. For this purpose it is pumped into the holding tank for sludge settling, reduction of excess chlorine, and adjustment of the *p*H. In use, the treatment solution contains an excess of chlorine for rapid oxidation of the cyanate and breaking up of the copper cyanide complex. After the necessary analysis and chemical additions, the contents of the holding tank are slowly bled into the drain, and the sludge is drained into a sludge sump from which it is pumped onto the sludge bed. For added convenience, the holding tank is large enough for two batches of treatment solution; thus, analysis and treatment of the contents may be performed at the convenience of the operator only once every two months.

The Alkali and Acid Treatment System

Fig. 10 shows the alkali and acid neutralization setup. The holding tank has sufficient capacity to hold several batches of cleaners and acid dips. The acid breaks the oil emulsion in the cleaner, and the quantity of alkali is sufficient to neutralize the free acid and to precipitate the metallic salts in the discarded dips. Once every two or three months, after a *p*H check, the clear supernatent liquid is drained off and the oil scum and sludge discarded to the sludge bed.

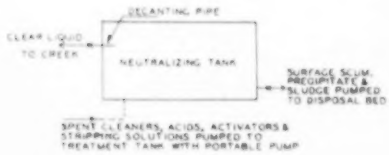
DECANTING PIPE
CLEAR LIQUID TO CREEK
NEUTRALIZING TANK
SURFACE SCUM, PRECIPITATE & SLUDGE PUMPED TO DISPOSAL BED
SPENT CLEANERS, ACIDS, ACTIVATORS & STRIPPING SOLUTIONS PUMPED TO TREATMENT TANK WITH PORTABLE PUMP

Fig. 10. Diagram of the alkali and acid neutralizing system

Miscellaneous Provisions

Provisions are made for safe discard of the sludge from the nickel and copper filters, washing of filter and anode bags, scrubbing of lead anodes, etc. As the drain system is segregated, in the event that any processing tank would spring a leak or overflow, the particular drain system may be shut-off to prevent toxic waste from entering the creek. An automatic safety system shuts the boiler-condensate return lines and sounds an alarm in case any of the steam coils develop a leak.

Operating Cost

The whole treatment system functions with a minimum of operating cost. The treatment processes require the same care and supervision as normally given to any electroplating process. Control is simplified so that only *p*H and test-paper checks are needed, save one bimonthly titration for chlorine in the cyanide-treatment setup.

Conclusions

(1) The requirements of the sanitary authorities have been fully met, with cyanide and hexavalent chromium kept below 1 ppm in the effluent.

(2) With the aid of the "integrated waste-treatment system", waste treatment is reduced to a simple step in the plating process.

(3) The cost of the necessary equipment is a small fraction of the cost of the productive equipment, and the operating expenses may be easily balanced by the beneficial effects of the waste treatment on the work in process.

References Cited

[1] L. E. Lancy, **Metal Finishing 49**, 56-59 (February, 1951).
[2] L. E. Lancy, Patent applied for.

SOME CHARACTERISTICS OF ZINC-CYANIDE PLATING SOLUTIONS

II. HARING CELL THROWING POWER

GUSTAF SODERBERG, *Editor*, PLATING

INTRODUCTION

The word throwing power, or "throw", has been used to denote several different concepts. As employed here it pertains solely to plate thickness.

In the Haring Cell[1], one cathode is placed farther away from the anode than a second cathode, and the throwing power is expressed as follows:

$$\text{Throwing Power} = 100\,\frac{\text{distance ratio}-\text{thickness ratio}}{\text{distance ratio}}$$

For example, if one cathode is five times as far from the anode as the other cathode, and the deposit on the near cathode weighs four times as much as the deposit on the far cathode, the distance ratio is 5 and the thickness ratio, 4. Hence the throwing power, in per cent, is

$$100\,\frac{5-4}{5} = 20$$

As pointed out by Blum *et al.*[2], the Haring-cell throwing power is not a "characteristic" of the solutions in the strict meaning of the word; it includes both solution variables and cell-size factors. The cell is useful, however, in classifying solutions with respect to their ability to deposit coatings of uniform thickness on articles with recesses.

EXPERIMENTAL

A Haring cell made of hard rubber was employed. At each end was placed a tightly fitting cold-rolled SAE 1010 steel cathode, which had been cleaned and weighed in the same manner as the efficiency-test cathodes of Part I of this series of articles[3]. A tightly fitting fine steel gauze electroplated with zinc was placed as the anode between the cathodes. After the cell had been filled to the mark with plating solution, its dimensions were as follows:

Electrode area and solution cross section	1 dm²
Distance from anode to far cathode	12.5 cm
Distance from anode to near cathode	2.5 cm
Distance ratio	5

The cell was connected in series with an ammeter, a carbon-pile rheostat, and a 12-volt lead storage battery. Plating was continued only as long as the temperature throughout the solution remained at 77 ± 2° F (25 ± 1° C). For that reason the average thickness of zinc on the cathodes was always very low. It averaged 0.000065 inch (1.6 μ) throughout the investigation, but varied a great deal from one determination to another.

At the end of the plating period, the cathodes were removed, rinsed under the tap, in distilled water and in alcohol. After they had dried in the air, they were placed in a dessicator until they were ready for reweighing. The Haring-cell throwing power was then calculated.

RESULTS

The results are presented in the three-dimensional graphs of Fig. 1. The usefulness and use of such graphs were discussed in Part I[3].

Some of the limitations on the scope and accuracy are set forth in Part I. In addition, it will be noted that in this study of throwing power only a few measurements were made with solutions containing 3.5 and 4.5 oz/gal (26 and 34 g/l) of zinc, limiting the scope still further, and that the accuracy is lower because of the larger number of measurements involved in each determination.

DISCUSSION OF RESULTS

The changes in throwing power with changes in solution composition or cathode current density are not as straight-forward as the corresponding changes in cathode current efficiency reported in Part I[3]. The reason is, of course, that throwing power is not a simple characteristic. Also, the errors are undoubtedly larger.

Within the limited ranges that can be compared, with total-cyanide and total-zinc contents remaining constant, the throwing power decreased rather sharply with increasing zinc content. However, at high current density (50 asf, or 5.4 amp/dm²) and high total-cyanide content (12 oz/gal, or 90 g/l) there was no change in throwing power with increased zinc content.

The general effect of an increase in total-cyanide content, at constant zinc and total-caustic contents, was an increase in throwing power. Exceptions were found at low zinc content (2.4 oz/gal, or 18 g/l) and high current density (50 asf, or 5.4 amp/dm²) where an increase of total cyanide from 8 to 12 oz/gal (60 to 90 g/l) caused a decrease in throwing power. This decrease was the cause of the lack of effect of increased zinc content mentioned above.

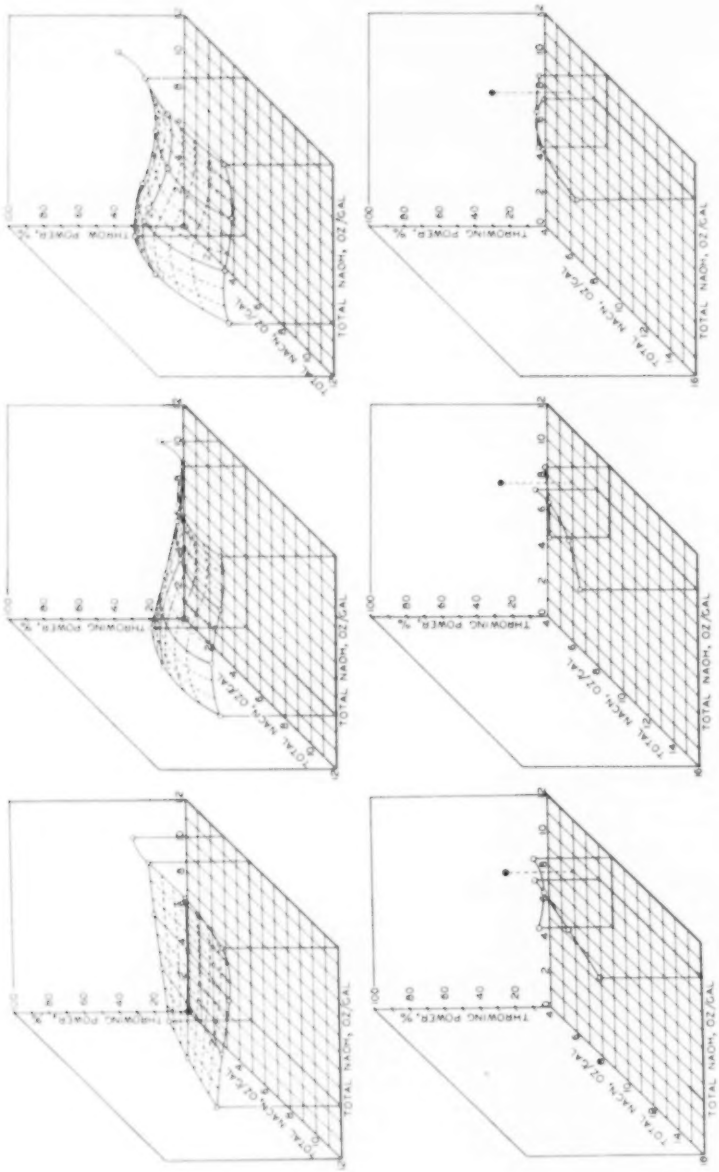

Fig. 1. Haring-cell throwing power of zinc solutions at 77° F. Top graphs: 2.4 oz/gal of zinc; bottom graphs: 4.5 oz/gal of zinc, except for the filled dots which are for 3.5 oz/gal of zinc. From left to right: 10, 30 and 50 asf average current density on the two cathodes in the cell. Each 1/8-inch elevation over the base plane represents 10 per cent throwing power

No general rule can be formulated for the effect of total-caustic content. A trend is discernible, however, at low zinc content (2.4 oz/gal, or 18 g/l). When the total-cyanide content was low (5 oz/gal, or 38 g/l) an increase in total NaOH from 3 to 12 oz/gal (22 to 90 g/l) caused the throwing power to rise from 47 to 57 per cent at 10 asf (1.1 amp/dm²), but at 30 and 50 asf (3.2 and 5.4 amp/dm²) the throwing power decreased from 55 to 36 per cent and from 63 to 46 per cent respectively. As the total-cyanide content was increased this trend tended to reverse itself. Thus, at 12 oz/gal (90 g/l) of total NaCN, as the total-caustic content was raised gradually from 3 to 12 oz/gal (22 to 90 g/l), the throwing power first dropped and then rose at 10 and 50 asf (1.1 and 5.4 amp/dm²) and first rose and then dropped at 30 asf (3.2 amp/dm²).

Within the range explored at 4.5 oz/gal (34 g/l) of

(Continued on page 260)

BARREL FINISHING

*II. Selection of Equipment**

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No organization which is considering investing in a barrel-finishing department need have any uncertainty as to whether or not that investment can be justified. This is one field where the application of the process, and the savings it will effect, can be proved in advance of spending one penny for equipment.

Conscientious suppliers offer a sample-parts processing service that takes the guesswork out of each individual case. The customer sends a comparatively small number of parts for processing. When this has been done, the parts are returned with a complete report on time cycles, loads, etc. It is then a matter to determine whether the results are satisfactory and whether the savings over the existing finishing methods will justify the investment in equipment. Actually, many plants pay for their entire capital investment in less than six months through savings in labor costs alone.

It is only under unusual circumstances, however, that large installations are advocated at the very start. In most cases, it is well to start modestly and expand as new applications prove themselves.

Even a modest start, however, deserves careful planning, so that as expansion becomes advisable, it can be done to the best advantage and with as little as possible revamping of floor plan or discarding of outgrown equipment.

With this in mind, it may be helpful to discuss, briefly, the various types of equipment and their application to different conditions.

Barrels

The multitudinous sizes, shapes and quantities of parts to be processed by the industry, and the widely varying specifications for such things as radii, surface finish and lustre, make necessary a wide range of sizes and shapes of tumbling barrels.

Parts range in size from those that are so small that they must be handled by tweezers to those that are so large, heavy, and critical that only one of them can be processed at a time. In some cases, only very rough deburring and cutting-down are required; in others, the parts require a burnished finish equivalent to hand buffing.

The work-horse of the industry is the fully enclosed horizontal octagonal barrel which is now recognized as the most effective for modern techniques of deburring, smoothing and burnishing. In various forms and sizes, this type of barrel serves many different purposes.

As was pointed out in Part I of this series, variable speed is essential for the modern rolling barrel. In general, a range from 8 or 10 rpm to 25 rpm is considered the accepted standard. Excellent results are accomplished by a Reeves Drive, with its infinite choice of speeds between the two extremes. With it, speed changes can be made while the barrel is in motion and without the cumbersome changing of V-belts. This drive has another distinct advantage in that it permits the use of standard electric motors which in case of failure may be replaced from local stock, with the minimum of down-time.

Forward and reversing motion is essential for proper positioning of the barrel for loading and unloading as well as for most effective operation in many other respects. A further "must" is a positive braking mechanism to hold the barrel in any given position and to prevent accidental dumping of the load.

Fig. 1. A 15-cu ft Murco barrel used for processing of sewing-machine parts. Courtesy the Reece Corporation

*Part I, Some Fundamentals, was presented in the December, 1951 issue.

Fig. 2. A 24-cu ft Murco barrel used for definning and finishing of intricate diecastings for the Armed Services. Courtesy D. J. Murray Manufacturing Company

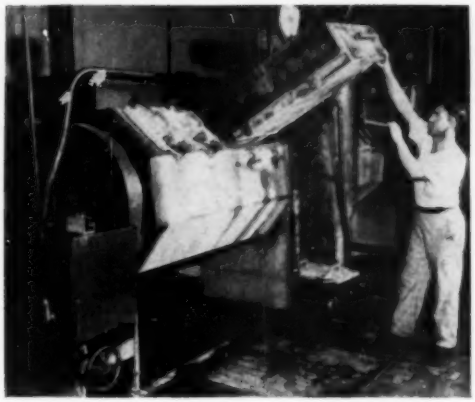

Fig. 3. A 36-cu ft Murco barrel for deburring of large aircraft parts. Courtesy Hartford Machine Screw Company

For large lots

Most high-production finishing can be handled with a few barrel sizes. The writer's company makes three in order to serve all conditions of total volume and size of part.

The smallest of these high-production units (Fig. 1) has a 2-compartment barrel section measuring 30 inches (76 cm) across the flats of the octagon by 32 inches (81 cm) long. Each compartment has a total capacity of 6½ cu ft (0.18 m³) giving the barrel a total capacity of 13 cu ft (0.37 m³).

This size is most universally used, as it is large enough to turn out a large volume of work and small enough not to be wasteful on somewhat smaller runs. It is particularly adaptable where moderate quantities of numerous different parts are to be processed, and in cases of multiple installations, it provides greater flexibility than a fewer number of larger units.

Where larger quantities of individual parts are to be finished, still greater savings in unit cost are made possible with the next larger size (Fig. 2) which measures 32 inches (81 cm) across the flats by 48 inches (122 cm) long. Each compartment has a capacity of 12 cu ft (0.34 m³).

For very large volume, or where extra large parts are involved, the largest unit measuring 36 inches (91 cm) in diameter by 60 inches (152 cm) long (Fig. 3) offers the greatest efficiency and cost reduction. Each of its two compartments has a capacity of 18 cu ft (0.51 m³).

For small parts or small lots

Many plants have the problem of processing large quantities of small parts or small quantities of a large variety of parts. To attempt to handle such lots in the larger units mentioned would be wasteful of abrasive and compounds or would involve far too much time and labor in separation of several lots at the end of the cycle.

For such situations, a special unit with small octagonal drums mounted at each end of a common drive shaft may be employed. Such units, designed by the author's company (Fig. 4), will take three different sizes of interchangeable drums with capacities of 1, 2, and 3.3 cu ft (28, 57 and 85 l).

Such barrels are also equipped for both forward and reversing motion, as well as with discharge chutes, which both facilitate unloading and provide added protection during unloading of delicate or critical parts.

Such small-diameter barrels are run at somewhat higher speeds than the larger units, the usual range being 18-36 rpm.

Submerged Rolling

The production of very high lustre is normally accomplished by the use of hardened-steel burnishing balls or shapes with suitable burnishing compound. (A very recent development in the form of a burnishing emulsion now permits almost equivalent results to be secured with abrasive chips.)

This burnishing operation is conducted in barrels of smaller diameters, and excellent commercial finishes can be secured in any of the barrels mentioned from the 30 x 32-inch size down.

For the ultimate in high lustre, however, the jewelry trade has taught us the art of submerged tumbling. In such equipment, a perforated hexagonal drum revolves in an enclosed tank containing the burnishing liquid. For reasons which are too lengthy to discuss here, submerged rolling produces far higher color and finer micro-inch finishes than can be obtained by any other method of barrel finishing. For these reasons, more and more elements of the metal-finishing industry are turning to this operation for their final finishes.

Self-Tumbling

Certain types of parts, usually small in size and noncritical in nature, can be rolled in open-end tilting-

type barrels. With the addition of a powdered abrasive, these parts rub or knock against each other and remove burrs or round edges without the use of abrasive chips. Where this can be done, a saving is made by the elimination of separation and handling of heavy loads of chips.

Special Equipment

Occasionally, special situations arise for which conventional equipment is not suited but which can be solved with a little imagination and ingenuity. Examples are the barrel finishing of tiny watch parts to even closer tolerances than by hand with tremendous savings in labor cost, and tumbling of long thin bars and strips for office machines which would have been distorted and made unusable in conventional equipment.

Tumbling of Plastics

Barrel finishing is an accepted procedure for the processing of many types of plastic parts. It is usually separated into three or four operations, namely, defining, cutting down, smoothing, and burnishing to final lustre. It may be possible to eliminate some of these steps if the condition and finish of the original piece is good.

Because plastics weigh so much less than metal parts, barrels for processing of plastics can be considerably lighter in construction and require less driving power. All, however, are of the horizontal, octagonal type.

Definning barrels differ from those used in the other operations only in that the walls are heavy mesh. The openings in the mesh permit the broken fin pieces to drop through and out of the way.

All barrels for the other operations have solid walls and are exactly the same for all three steps. Care must be taken, however, to keep a separate compartment (or separate barrel) for each different operation to avoid possible contamination.

Drainage Doors

Drainage doors are required for proper rinsing of both load and medium. After the rolling is completed, the regular compartment door is replaced by the perforated drainage door to permit rinsing, without dumping of the load, in preparation for the finishing cycle.

Power Hoist and Hoist Pans

Some shops still load their barrels with a hand shovel, but that not only wastes time in a busy shop but is really hard labor. The aluminum oxide type of abrasive weighs approximately 125 lb/cu ft (2 kg/l), and burnishing balls and shapes run about 200 lb/cu ft (3.2 kg/l). In addition, there is the weight of the parts themselves.

In any multiple-barrel installation, therefore, we strongly recommend a gantry type of overhead electric hoist to handle dump pans constructed to fit each size of barrel. They receive the medium direct from the storage bins and, with the aid of the hoist, carry it to and dump it into the barrels. Parts to be processed can be handled at the same time or in a separate load. At the end of the cycle, the same hoist pans are placed under the barrel, and the load is dumped into them for transfer to the separator.

Fig. 4. A Duplex barrel for deburring and finishing of parts on an ordnance contract. Courtesy American Standard Watch Co.

Overhead gantry cranes are preferred to the "dolly" type of hoist, a tubular frame on casters with an electric hoist in the center. The latter has the advantage that it can be pushed from place to place, and its cost is low. Numerous users, however, have had bad experiences with such dollies. Unevenness or cracks in the floor, or even spilled parts, can cause them to tip over, sometimes resulting in serious accidents.

Chip Storage Bins

As abrasive must be handled repeatedly and in relatively large amounts, arrangements should be made for storing and handling it as efficiently as possible. Specially constructed chip storage bins are almost a "must" for any installation. These are mounted on legs so that hoist pans can be placed underneath them and loaded through a chute in the bottom front of the bin. When chips are to be returned to the proper bin, the hoist pan is raised above the bin and the chips dumped into it.

This method of storing reduces manual labor and saves time. It also conserves floor space to the greatest possible extent.

Separating Equipment

The problem of separation faces every barrel-finishing department, large or small. Parts must be separated from chips or other media. As chips begin to wear, they must be separated as to size.

Equipment for this operation varies all the way from a wooden frame with a screen in the bottom, which is shaken by hand, to large, complicated machinery which handles tons of material on a continuous and automatic basis.

For the small shop, a screening device which fits right over the hoist pan is probably sufficient. The contents of the barrel are dumped onto the screen, and

as this is agitated, the chips fall into the hoist pan while the parts remain on top of the screen.

A variation of this, for the slightly larger shop, is the separating table. This is also operated by hand, but will take care of a larger volume.

For a department with three or more barrels, a hopper-type power-driven separator will usually pay for itself in a few months. Here the hoist pan dumps the combined load into a hopper which feeds it onto a power-operated oscillating screen. This, in turn, delivers the chips into another hoist pan for reloading and the parts into any appropriate container.

Where small ferrous parts are being processed, a hand magnet serves advantageously both for actual separation and for transferring the parts from the screen to an appropriate container. The magnet is so constructed that it can be operated with one hand, and it is a great time saver.

For larger volume, power-driven magnetic separators are often the answer. The hopper feeds the mixed load to a revolving, permanent-magnet drum. Nonmagnetic material, such as abrasive chips, drops into a hoist pan, while the magnetic parts are carried on an endless belt and discharged into a suitable receptacle. Such separators may be equipped with a demagnetizer for the parts if this proves advisable.

Drying and Rust Proofing

The final step after separation is drying of the parts. This is essential with all ferrous and most nonferrous parts. Again, there is a wide choice of equipment to fit varying conditions.

Special drying sawdust and corn-cob meal are the usual drying media. In many shops, they are used at ordinary room temperature; in others, arrangements are made to keep the medium warm. This not only dries the parts quicker and more effectively but keeps the medium dry and prolongs its effective life.

Many shops with small and light parts simply build a sawdust table with 6-8-inch high sides into which a few bags of sawdust are dumped. The parts are thrown in and mixed thoroughly. Then simple hand screening separates the dried parts.[5] Such drying tables may also be equipped with steam coils.

For the larger operation, drying barrels of either the horizontal or the open-end tilting type are available. Some of these are equipped with steam jackets to keep the sawdust hot.

For really high production, a fully automatic rotary drier is the most economical unit. The parts go in one end and are mixed with the sawdust as they travel the length of the machine. At the other end, they are discharged, and the sawdust is returned to the drying chamber to be heated and reused.

It is often necessary to dip ferrous parts in a rust-proofing material for temporary protection between manufacturing operations or for longer periods of storage or transportation.

In general, the use of one overall product is most satisfactory. This is a special polar-type rust-proofing oil made to government specifications U. S. Navy 52-C-186, Grade III and Canadian Specification DND-702.

This type of product has very effective water displacement characteristics and gives effective rust protection up to 6 months. It leaves a very clear, fine oil film of 0.0003-inch (8-μ) maximum thickness, which permits inspection of the parts themselves without removal of the film. Because the film is extremely thin, it covers 1,200–1,600 sq ft/gal (30–39 m^2/l) and is very economical to use.

Conclusion

As has been shown, the equipping of a barrel-finishing department involves multiple choices in almost every piece of equipment, and careful thought should be given to its selection. Those without experience with the process will do well to consult some organization that is thoroughly familiar with all types of equipment to make sure of a completely integrated department.

Zinc Cyanide

(Continued from page 256)

zinc, an increase in the total-caustic content had little effect.

Broadly speaking, at a zinc content of 2.4 oz/gal (18 g/l), an increase in cathode current density was effective in raising the throwing power when the total-cyanide and total-caustic contents were low. High total-cyanide content, however, partially reversed this effect, and the lowest throwing power was had at the highest current density (50 asf, or 5.4 amp/dm^2).

Within the narrow range studied at 4.5 oz/gal (34 g/l) of zinc, the throwing power dropped with increasing current density at the lowest total-cyanide content (8 oz/gal, or 60 g/l), but rose with increasing current density at the highest total-cyanide content (16 oz/gal, or 120 g/l). At intermediate total-cyanide contents (9–12 oz/gal, or 68–90 g/l) the throwing power first dropped to a minimum at 30 asf (3.2 amp/dm^2) and then rose again.

Although only relatively few tests were carried out in solutions containing 4.5 oz/gal (38 g/l) of zinc, they do show that high-zinc solutions can have equally high throwing power as low-zinc solutions, but only when the total-cyanide content is very high, and then particularly when the higher current densities are employed.

Conclusions and Acknowledgments

These will be presented in the final installment of this series.

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[1] H. E. Haring and W. Blum, Trans. Electrochem. Soc. 44, 313 (1923).
[2] W. Blum, A. O. Beckman and W. R. Meyer, ibid. 80, 256 (1941); "Modern Electroplating", The Electrochemical Society, New York (1942), p. 14.
[3] G. Soderberg, Plating 38, 928 (1951).

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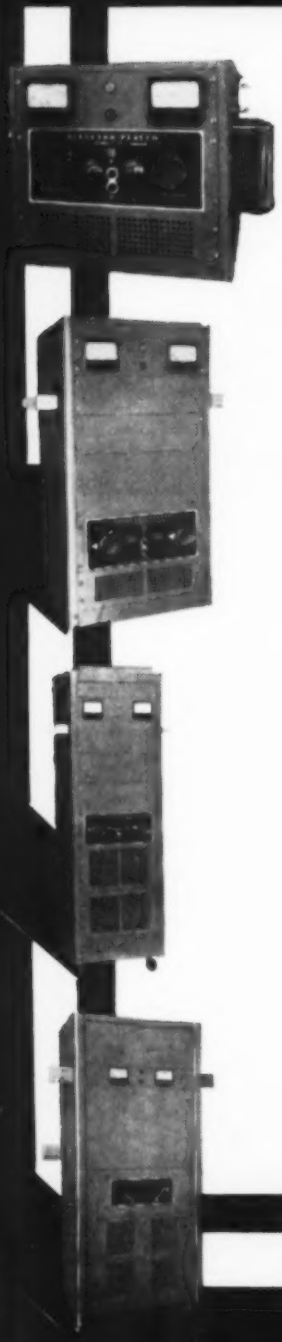

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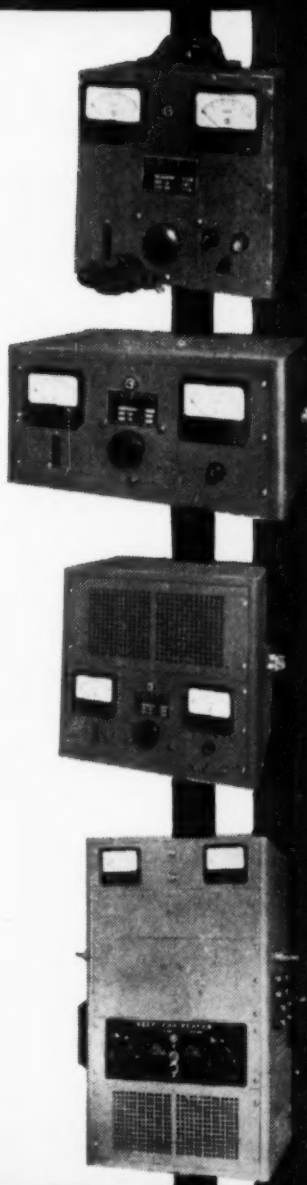

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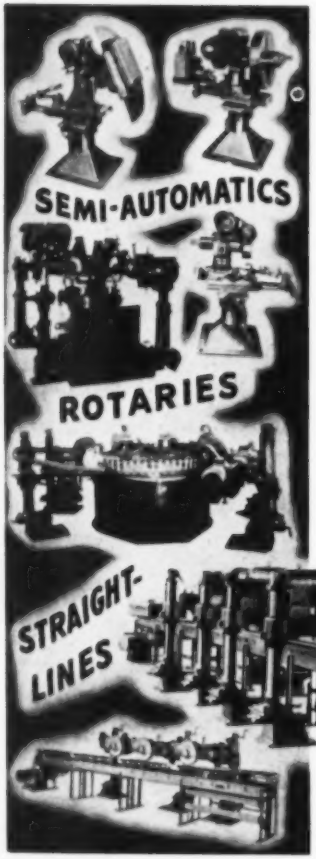

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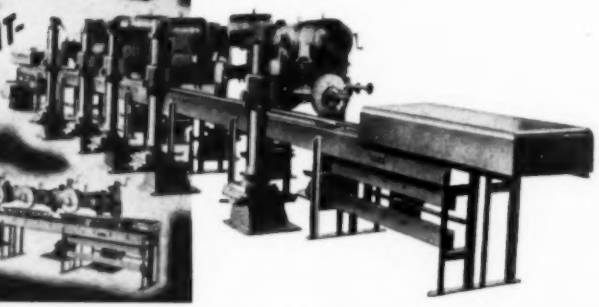

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TENTATIVE RECOMMENDED PRACTICE FOR

PREPARATION OF AND PLATING ON ALUMINUM ALLOYS[1]

A. S. T. M. Designation: B 253–51T, Issued 1951[2]

This Tentative Recommended Practice has been approved by the sponsoring committee and accepted by the Society in accordance with established procedure, for use pending adoption as standard. Suggestions for revisions should be addressed to the Society at 1916 Race Street, Philadelphia 3, Pa. which also supplies reprints.

Scope

1. (a) Various metals are electrodeposited on aluminum alloys to obtain a decorative finish or one which is more wear resistant or suitable for some other specific service. The electroplates applied for finish are usually chromium, nickel, copper, brass, silver, gold or modifications of these. Silver is applied to electrical equipment to decrease contact resistance or to improve surface conductivity; brass to facilitate vulcanition of rubber to aluminum; copper, nickel or tin for assembly by soft soldering; chromium to reduce friction and obtain increased resistance to wear; zinc to threaded parts where organic lubricants are not permissible; while tin is frequently employed to reduce friction on bearing surfaces.

(b) This recommended practice is presented as a guide for the plating of aluminum alloys. Electroplating of these alloys is commercially practical and economically sound. Aluminum alloys, however, do not respond satisfactorily to many of the usual preparatory procedures for plating; hence, different procedures are required to obtain a satisfactory basis for plating. Of the different methods available, the zinc-immersion method is considered to be the most satisfactory and practical for plating substantially all of the different aluminum alloys with various other metals.

Nature of Aluminum

2. (a) *Microstructure.*—It has been difficult to find a preplating procedure that will be equally satisfactory for all types and tempers of aluminum alloys because the various alloys and products behave differently electrochemically since they have different metallurgical structures. When elements are added for alloying purposes, they may appear in an aluminum alloy in several different forms; that is, they may be in solid solution in the aluminum lattice, be present as micro-particles of the elements themselves, or be present as particles of intermetallic compounds formed by combination with the aluminum. The several solid solution matrices and the twenty or more microconstituents that may occur in commercial alloys may have different chemical and electrochemical reactivities, and their surfaces may not respond uniformly to various chemical and electrochemical treatments. In addition, the response may be influenced by variations in the microstructure of different lots or products of the same alloy. The plater should know, if possible, the type of aluminum alloy that is to be plated in order to select the best plating procedure.

(b) *Oxide Film.*—In addition to differences in microstructure that may affect response to preplating conditioning treatments, all aluminum products have an ever-present natural oxide film. This oxide film can be removed by various acid and alkaline treatments, but after rinsing, the surface will still have an oxide film that re-formed during the treatment. For best results with the zinc-immersion process, the new oxide film should be thinner and more uniform and provide a suitable surface for deposition of the zinc-immersion layer.

Cleaning and Conditioning Treatments

3. (a) To obtain consistent results with the zinc-immersion process for plating aluminum alloys, it is essential that the various cleaning and conditioning treatments provide a surface of uniform activity for the deposition of the zinc layer. First, the surface should be free of any oil, grease, or other foreign material. For removing oil or grease, vapor degreasing or solvent cleaning may be necessary. Ordinarily, a mild etching-type alkaline cleaner is recommended. One can be made conveniently by using 23 g per l (3 oz per gal) each of sodium carbonate and trisodium phosphate. This solution should be used at a temperature of 140 to 180° F (60 to 82° C) for 1 to 3 min.

(b) After appropriate cleaning, further treatment of the surface is generally required. For this conditioning

[1] Under the standardization procedure of the American Society for Testing Materials, this recommended practice is under the jurisdiction of the A. S. T. M. Committee B-3 on Electrodeposited Metallic Coatings.

[2] Accepted by the American Society for Testing Materials at Annual Meeting, June, 1951.

treatment to be effective, it must accomplish two things: (1) remove the original oxide film; and (2) remove any microconstituents which may interfere with the formation of a continuous zinc-immersion layer or which may react with subsequent plating solutions.

(c) For wrought alloys of the 990A and M1A types[2], fairly good conditioning may be obtained by using the carbonate-phosphate cleaner followed by a dip in a nitric acid solution (50 per cent by volume). These alloys do not contain interfering constituents, and for some applications this method of conditioning may be ample.

(d) One of the more effective conditioning treatments for removing the surface oxide film and any undesirable microconstituents comprises the use of a *hot acid etch containing sulfuric acid (15 per cent by volume) for a period of 2 to 5 min at a temperature of 180° F (82° C)*. The time of the dip depends upon the alloy involved. Generally the shorter time is used on castings. This treatment is satisfactory for all wrought and most cast aluminum alloys. It not only leaves the surface in an excellent condition for the formation of the zinc-immersion layer, but it also eliminates the undesirable effects of the magnesium-containing constituents in alloys of the GR20A[3], GS11A[4], and GS10A[4] types.

(e) Another conditioning treatment which has considerable merit consists of *a double zinc-immersion treatment with the first zinc layer being removed by a dip in a nitric acid solution (50 per cent by volume)*. This treatment has been found to be very effective for use with many cast alloys and with wrought alloys that do not contain appreciable percentages of magnesium and when the identity of the alloy is not known. With this procedure, the first immersion dip removes the original oxide film and replaces it with a zinc layer. Removal of the zinc layer by the nitric acid dip leaves the surface in suitable condition for deposition of the final zinc-immersion layer.

(f) For casting alloys containing high percentages of silicon, S5[5], SC64C[5], SG70A[4] and SC7[5] type alloys, *a dip for 3 to 5 sec in a solution containing 3 parts (by volume) of concentrated commercial nitric acid plus 1 part (by volume) of commercial hydrofluoric acid (48 per cent)* is recommended for conditioning the surface.

Zinc Immersion

4. (a) In the zinc-immersion step, the oxide film is removed from the surface to be plated and is replaced by a thin and adherent layer of metallic zinc. This provides a surface that will respond to most of the plating procedures for depositing other metals.

(b) For the immersion step, a highly alkaline solution[7] containing the following components is used at room temperature (60 to 80° F; 16 to 27° C):

Zinc-Immersion Solution	
Sodium hydroxide, commercial (76 per cent Na_2O)	70 oz per gal (525 g per l)
Zinc oxide (Technical Grade)	13 oz per gal (100 g per l)

The thickness and quality of the immersion coating are influenced by the conditions of deposition. When deposition is too rapid, heavy coarsely crystalline and non-adherent deposits are formed. Since the thinner zinc deposits give the best results, it is recommended that the temperature of the zincate solution be kept below 80° F (27° C) and the immersion time be from 30 sec to 1 min.

(c) The zincate solution is very viscous and losses occur largely from drag-out. This is advantageous as it limits the accumulation of impurities resulting from attack on the aluminum.

(d) The specific gravity of the solution should be checked occasionally and any loss made up by adding more of the components. Loss of volume by drag-out should be corrected by the addition of more solution of the specified composition.

(e) When a properly conditioned aluminum alloy article is immersed in the zincate solution, the thin natural oxide film that is present on the surface of the article dissolves, and as soon as any underlying aluminum is exposed, it also starts to dissolve and is immediately replaced by an equivalent weight of zinc. When the aluminum surface is completely covered with an extremely thin layer of zinc, action in this solution virtually ceases.

(f) With correct procedure, the resulting zinc deposit will be fairly uniform and firmly adherent to the surface. The appearance of the surface, however, will vary with the alloy being coated as well as with the rate at which the coating forms. The weight of zinc deposit should be of the order of 0.1 to 0.3 mg per sq in (0.016 to 0.048 mg per sq cm) (0.02 to 0.07 μ in thickness). Generally, it is desirable to limit the weight of the deposit to not over 0.2 mg per sq in (0.03 mg per sq cm).

(g) The thinner and more uniform zinc deposits are the most suitable for plating preparation and for the performance of plated coatings in service. Heavy zinc deposits tend to be spongy and less adherent and do not provide as good a surface for obtaining adhesion as the thinner deposits. The weight of zinc deposit will vary with the alloy and the conditioning treatment that is used.

(To be continued)

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[2]See Tentative Specifications for Aluminum and Aluminum-Alloy Sheet and Plate (A. S. T. M. Designation: B 209), 1950 Supplement to Book of A. S. T. M. Standards, Part 2.

[3]See Tentative Specifications for Aluminum and Aluminum-Alloy Extruded Bars, Rods, and Shapes (A. S. T. M. Designation: B 221), 1949 Book of A. S. T. M. Standards, Part 2.

[4]See Tentative Specifications for Aluminum-Base Alloy Die Castings (A. S. T. M. Designation: B 85), 1950 Supplement to Book of A. S. T. M. Standards, Part 2.

[5]See Tentative Specifications for Aluminum-Base Alloys in Ingot Form for Sand Castings, Die Castings, and Permanent Mold Castings (A. S. T. M. Designation: B 179), 1950 Supplement to Book of A. S. T. M. Standards, Part 2.

[7]Proprietary sodium zincate solutions of this general type are available commercially.

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Acknowledgment is due the Research Committee, Mr. William Tucker, Eastman Kodak Company, Chairman; the Research Directing Sub-Committee, Mr. B. C. Case, Hanson-Van Winkle-Munning Company and Dr. R. M. Wick, Bethlehem Steel Company, Chairman and Vice-Chairman, respectively; Project Committee No. 2, Dr. D. Gardner Foulke, Hanson-Van Winkle-Munning Company, Chairman, and Dr. Walter R. Meyer, Enthone, Inc.; and Project Committee No. 10, Mr. Henry B. Smith, R. Wallace & Sons Mfg. Company, Chairman; Mr. M. A. Orr, International Silver Company, and Mr. F. J. Holt, E. I. du Pont de Nemours & Company, for their contributions to this project.

*AUTHORS

Analytical Methods for the Determination of Cyanides in Plating Wastes and in Effluents from Treatment Processes

Introduction

The purpose of this paper is to provide electroplaters with reliable and reasonably simple methods for determination of cyanide in the various types of solutions and at the various concentrations that will be encountered in the treatment and disposal of liquid wastes. The two methods herein recommended have been selected from an experimental investigation of about eight different methods given in the literature. They are intended to determine total cyanide, i. e., not only the cyanide present as the anion, CN^-, but also that which is present in various complexes with metals. Although the latter form of cyanide is undoubtedly far less toxic than CN^- ions, it is possible for such ions to be liberated from the complexes under certain conditions; they are therefore potential hazards and as such should be destroyed along with free cyanide. With this in view, we have chosen to present methods which will determine total cyanide.

Most published analytical methods for cyanides cannot be used without modification to determine total cyanide in electroplating solutions. The presence of stable metallo-cyanide complex ions, wetting agents, or other interfering substances affects these tests in such a way that it is necessary to resort to acidification with a stable mineral acid, distillation, and absorbtion of the evolved hydrogen cyanide gas in an alkaline solution. This breaks up the complex ions and also leaves behind most of the interfering substances. At times some of the interfering substances are also decomposed in this process, and gaseous products are volatilized together with the hydrogen cyanide. Since the volatile products may also interfere with the methods of analysis, it is necessary to add to the cyanide solution, prior to acidification and distillation, compounds which either stabilize such interfering substances or react with their products of decomposition. With distillation it is also possible to analyze much smaller amounts of cyanide than could be analyzed directly, since the distillate can be made several times as concentrated in cyanide as the original solution.

In view of these facts *it is advisable to distill samples prior to their analysis.* The method of distillation described in this paper will effectively decompose silver, cadmium, copper, zinc and nickel cyanide complexes. A modification of this method, which requires a longer distillation time, should be used if it is desired to determine the cyanide which is combined as iron complexes. The methods of analysis herein suggested are to be applied to the determination of the cyanide concentration in the distillate, from which the cyanide concentration of the original sample can be calculated. The proposed methods are (1) two modifications of the well-known Liebig titrimetric method using silver nitrate solutions as standards and (2) the pyridine-pyrazolone colorimetric method[1].

One modification[2] of the Liebig titrimetric method involves the use of potas-

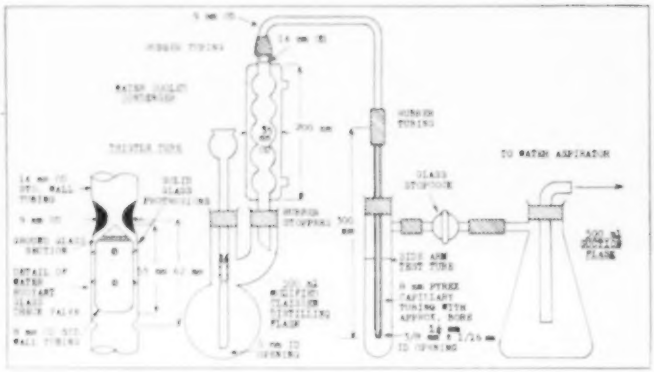

Fig. 1. Distillation apparatus. All dimensions are approximate unless tolerances are given

sium iodide indicator and ammonia for cyanide concentrations (as CN) varying between 20-10,000 ppm, and the other modification[2] involves the use of p-dimethylaminobenzalrhodanine indicator for cyanide concentrations varying between 1-20 ppm. The pyridine-pyrazolone colorimetric method enables one to analyze for cyanide concentrations in the range 0.07-1 ppm. All concentrations referred to are those in the distillate.

In the interest of completeness, it should be mentioned that a number of other methods were investigated before a decision was made to adopt the aforementioned methods.

The Prussian Blue method is very specific for cyanides, and is based upon the fact that the addition of a ferrous salt to a cyanide will result in the formation of the ferrocyanide anion which will in turn react with ferric ions to yield ferriferrocyanide, or Prussian Blue. Two modifications of this method were studied:

The Gettler-Goldbaum[3] method requires special tubes carrying filter-paper discs impregnated with ferrous sulfate through which the hydrogen cyanide gas is distilled. The Prussian Blue color is developed with acid and the filter disc compared with standards. This method is useful within the range of 0.1-1.0 ppm CN with an accuracy of 0.05 ppm in the lower range and 0.1 ppm in the upper range. The method, however, does not determine all of the cyanide that may be combined in cuprocyanide, ferro- or ferricyanide complexes. It should be applied to the distilled samples for the determination of total cyanide, but it would not be as simple and as accurate as the recommended pyridine-pyrazolone method.

A second Prussian Blue modification, known as the Friel-Wiest[4] method, involves the evaporation of cyanide to dryness, followed by the addition of a 2 per cent ferrous sulfate solution, acidification, and dilution to a specific volume. The Prussian Blue color is then determined with a colorimeter. Useful within the range 0.5-10 ppm of cyanide (CN), this method was passed over because of the greater simplicity of the Liebig method using p-dimethylaminobenzalrhodanine as an indicator for essentially the same range.

The phenolphthalin method depends upon the development of a red color in phenolphthalin solutions containing cupric ions in the presence of cyanide, presumably by oxidation. The intensity of the coloration is proportional to the cyanide content. Cyanide concentrations of the order of 0.1-4 ppm may be determined by this method. However, the interference of oxidizing agents, halogens, sulfides and other materials rendered this method of limited value.

Mention should also be made of a third variant of the Modified Liebig Titrimetric method developed upon a suggestion by Reams[5], in which a photoelectric colorimeter was employed to locate the end-point of the titration. In view of the accuracy in the same range (1-20 ppm) of the Liebig method using p-dimethylaminobenzalrhodanine as an indicator, without need for nephelometric equipment, the latter was adopted as a recommended method.

All concentrations given refer to the actual sample being analyzed, which will be the distillate in most cases. When the size of the original sample is equal to final distillate volume, the cyanide concentrations are the same, of course.

Distillation Procedure

Apparatus Required

The apparatus used for the distillation can be easily set up as shown in Fig. 1. The distilling flask is a Claissen flask in which the side-arm delivery tube has been removed and the opening sealed. The glass stopcock in the suction line is used to regulate the rate of air bubbling. A screw clamp in a rubber tubing may also be used. Other important accessories are: a small water-cooled Allihn condenser to reflux the water vapor back into the distilling flask; side-arm test tubes in the following sizes: 18 x 150, 25 x 200 mm, to hold the absorbing solution; a thistle tube* with a water-buoyant check valve† to prevent upward surges of the liquid, especially when the solution is near boiling; a water aspirator, and a suction flask which is used as a water trap.

Reagents Required

1. Sodium hydroxide solution—4 per cent by weight
   Dissolve 40 g of NaOH in 960 g of distilled water
2. Sodium sulfite solution—$\frac{1}{2}$ *M*
   Dissolve 12.6 g of anhydrous sodium sulfite in 50 ml of distilled water. Dilute to 200 ml in a volumetric flask. Make up fresh solution every week.
3. Concentrated sulfuric acid‡
4. Magnesium chloride solution—2.5 *M*
   Dissolve 102 g of $MgCl_2 \cdot 6H_2O$ in 100 ml of distilled water. Dilute to 200 ml in a volumetric flask.
5. Mercuric chloride solution—$\frac{1}{4}$ *M*
   Dissolve 34 g of $HgCl_2$ in 500 ml of distilled water at about 30° C. Dilute to 1 liter in a volumetric flask.

*The overall height of the thistle tube is 325 mm; the distance from the bottom of the thistle tube to the bottom of the check valve, 100 mm.

†This valve can be constructed by any competent glass blower. The following addresses are suggested: F. Pierce Noble, 110 Benham Street, Hamden, Conn., or Macalaster-Bicknell of Conn., Inc., 181 Henry Street, New Haven, Conn.

‡It has been found that concentrated ortho-phosphoric acid is better to use in the distillation of cyanide samples containing relatively large quantities of cyanide complexes of iron.

The distillation procedure is the same, whether phosphoric or sulfuric acid is used. If cyanide complexes of iron are present, as indicated by a deep blue coloration which develops immediately upon acidification of the cyanide sample, and if it is desired to determine total cyanide, including that which is present in the cyanide complexes of iron, it is necessary to distill for about 2½ hours instead of ½ hour, as suggested in the operating procedure. The disappearance of the deep blue coloration, which is much more intense than that caused by an equivalent gravimetric amount of copper sulfate, is an indication that the cyanide complexes of iron have been completely decomposed.

It has been found, however, that it is preferable to use sulfuric acid instead of phosphoric acid for the ½-hour distillation which is required to decompose completely cyanide complexes of cadmium, copper, silver and zinc in solutions containing 500 ppm of total CN. The use of ortho-phosphoric acid seems to give lower results than the use of sulfuric acid.

Operating Procedure

This method should be applied to solutions containing not more than about 500 ppm of total cyanide. If the sample contains more than 500 ppm of CN, it is advisable to dilute it, since higher concentrations require longer distilling time for complete recovery of cyanide, especially in the case of copper or brass plating solutions. Furthermore, the concentration of the sodium hydroxide solution would have to be increased proportionately to keep the *p*H value of the final solution above 12 and avoid loss of HCN.

Concentration by distillation may be effected by making the volume of absorbing solution small in comparison to the volume of the sample. In order to vary the degree of concentration, two different sizes of side-arm test tubes have been suggested. If the smaller, 18 x 150-mm, test tube is employed, a minimum volume of 15 ml may be used for the absorbing solution, thus making possible a 14-fold concentration by distillation from the 250-ml sample taken.

To achieve a still greater concentrating effect, a 1000-ml Claissen flask could be used and the volume of the sample increased to 500 ml. By using the smaller test tube for the absorbent, a 28-fold concentration by distillation may be effected. The procedure described below involves a 5- to 8-fold concentration by distillation, which is ample in most cases.

1. Place about 30 ml of 4 per cent NaOH solution in the larger of the two side-arm test tubes. Insert stopper with gas delivery tube and connect to distilling apparatus by means of rubber tubing.
2. Apply suction by passing water through aspirator and adjust bubbling rate with glass stopcock or screw clamp. The bubbling rate should be such that individual bubbles can be clearly seen.
3. If the sample contains oxidizing agents such as hypochlorites, add sodium sulfite dropwise until the solution gives a negative test with starch-KI indicator paper.
4. Pour 250 ml of the sample through thistle tube into distilling flask.
5. Add 20 ml of $\frac{1}{5}$-*M* $HgCl_2$ solution.
6. Add 10 ml of 2.5-*M* $MgCl_2 \cdot 6H_2O$ solution through thistle tube followed by about 5 ml of water to rinse.
7. After two minutes, add slowly 5 ml of conc. H_2SO_4 and wash with 5 ml of water.
8. Heat rapidly over gas flame.
9. As soon as solution begins to boil, regulate heat so as to have gentle boiling.
10. Distill for one-half hour, being sure that the air is bubbled through solution and absorbing medium at all times.
11. Close stopcock, or screw clamp, and disconnect the side-arm test tube from the distilling apparatus, being sure to drain and wash the residual liquid from the HCN delivery tube.
12. *The distillate is now ready for analysis according to one of the procedures illustrated below.* It may be analyzed "in toto" or it may be diluted to 50 ml in a volumetric flask in order that aliquots be taken. The latter procedure is generally to be preferred.

TABLE I. ANALYTICAL METHODS AND SUGGESTED CONCENTRATION RANGES

Method	Range ppm
Modified Liebig Titrimetric	
KI indicator	20–10,000
p-dimethylaminobenzalrhodanine indicator	1–20
Pyridine-Pyrazolone Colorimetric	0.07–1

Analytical Procedures

The methods of analysis for cyanide described in this paper are outlined in Table I, together with their practicable concentration ranges. The sensitivity, however, can be increased n-fold by an n-fold concentration of the sample through distillation.

The analytical methods will be discussed in the same order as presented in Table I. It will be done in three steps to permit a clear presentation of the methods as such and at the same time provide the necessary background for understanding the methods as well as the experimental data upon which their selection was based.

Discussion of the Methods

1. Modified Liebig Titrimetric Methods

1. Liebig method using KI-NH_3 indicator.—This method depends on the formation of a complex ion when a soluble silver salt is added to the solution to be analyzed, according to the following reaction:

$$2\,CN^- + Ag^+ = Ag(CN)_2^-$$

No precipitation occurs as long as there is an excess of CN^-, but as soon as the excess has disappeared and an excess of Ag^+ is present, the solubility product of the salt $AgAg(CN)_2$ is exceeded, and a white turbidity indicates the end-point. The halide salts and free chlorine do not interfere with the reaction. Sulfides and a large excess of alkalis, however, must be avoided. The former react with the silver ion to form black Ag$_2$S, and the latter dissolve some of the $AgAg(CN)_2$ causing higher titration values. If potassium iodide is used as an indicator, the more insoluble yellow precipitate of silver iodide will form after all of the cyanide ion has reacted with the silver ion. This end-point is more visible than the white silver cyanide end-point, and is not affected by the presence of a large excess of alkali.

The addition of ammonia together with potassium iodide prevents the formation of the silver cyanide precipitate before the stoichiometric point is reached, because of the formation of a complex silver-ammonia ion. Ammonia will not interfere with the precipitation of silver iodide, once the stoichiometric point has been reached, because of the extreme insolubility of silver iodide.

This direct method of titration can be used for quantitative determination of free cyanide ion only. Solutions containing cyanide complexes which cannot be decomposed by an alkali must be acidified and distilled prior to analysis. Solutions containing pure zinc cyanide complexes can be titrated directly after enough caustic has been added to dissolve the precipitate that forms initially. Solutions containing cadmium cyanide complex ions can be treated similarly, but because the cadmium hydroxide precipitate is not soluble in excess sodium hydroxide, it must be filtered off prior to the silver nitrate titration. Solutions containing copper, nickel and mercury cannot be analyzed directly[5].

2. Liebig Method using p-dimethylaminobenzalrhodanine indicator.—Potassium iodide is not a convenient indicator for titrating solutions containing less than 10 ppm of total cyanide. This was reported by Reams[6], who conducted an extensive investigation of the effect of $AgNO_3$ concentration, KI concentration, KI-to-$AgNO_3$ ratio, and time of contact on the excess silver nitrate required over and above the stoichiometric requirements to produce turbidity in very dilute cyanide solutions.

It is, therefore, necessary to use the more sensitive p-dimethylaminobenzalrhodanine indicator for analysis of solutions containing between 1 and 10 ppm of total cyanide. This indicator was used by Ryan and Culshaw[4] for the analysis of pure alkali cyanide solutions by titration with silver nitrate after having been de-

TABLE II. DETERMINATION OF TOTAL CYANIDE IN COMMERCIAL CYANIDE SOLUTIONS BY DISTILLATION AND LIEBIG TITRATION OF THE DISTILLATE

Solution Number and Kind	Laboratory A	B	C	D	E	F	G*	Mean from	Probable Error ‡	Actual CN ppm
1†	11.5	10.6	4.2	10.6	15.6	8.4	9.9	A-B-D-F		
Rinse	+11.6% ‡	+2.9%		+2.9%	...	−17.9%	...	10.3	7.3	10.3 ± 0.75
2	571	609.8	532.5	603	579	472	540	A-B-C-D-E		
Cd	−1.4%	+5.3%	−8.1%	+4.1%	0%	...	...	579.0	3.2	579 ± 18.5
3	323	353.3	336.9	359	342	288	336	A-B-C-D-E		
Brass	−5.78%	+3.1%	−1.7%	+4.7%	−0.2%	...	...	342.8	2.5	342.8 ± 8.6
4	483	491	461.8	494	483	249	475	A-B-C-D-E		
Cu	+0.1%	+1.7%	−4.5%	+2.4%	+0.1%	...	...	482.6	1.3	482.6 ± 6.3
5	580	609.8	624.0	636	616	329	564	A-B-C-D-E		
Zn	−5.4%	−0.5%	+1.8%	+3.73%	+0.5%	...	...	613.1	2.1	613.1 ± 12.9
6	42.8	44.1	43.1	43	40	57	40.3	A-B-C-D-E		
Brass	+0.5%	+3.5%	+1.2%	+0.9%	−6.1%	...	...	42.6	2.2	42.6 ± 0.94
7	2.3	2.1	2.3	...	...	1.8	...	A-B-C		
Ag	+3.1%	−5.8%	+3.1%	...	...	...	...	2.23	2.8	2.23 ± 0.06

*Ortho-phosphoric acid used instead of sulfuric acid.
†p-dimethylaminobenzalrhodanine used in 1A and 1D.
‡Percentage figures represent deviation.

veloped by Feigl[6] as a spot test for microquantities of silver ion in acid solution. It is sensitive to about 0.1 ppm of silver ion. Ryan and Culshaw found that they could use this indicator in basic solutions, such as cyanide solutions, provided that nearly all heavy metals were absent. This requirement is made necessary by the fact that the rhodanine component undergoes a tautomeric change, the product of which forms either a color or a precipitate with most heavy metals.

The p-dimethylaminobenzalrhodanine indicator at the end-point, changes in color from yellow to a light red-violet, and the change is instantaneous. Because of its sensitivity, the test will give an indication of silver as soon as a very small amount of silver ion has been added after all of the cyanide in solution has reacted to form the soluble silver cyanide complex ion.

II. The Pyridine-Pyrazolone Colorimetric Method

This method, which is sensitive and specific for the determination of cyanides in microquantities, involves the use of a pyridine-pyrazolone reagent developed by Epstein[1]. The cyanide is first converted into cyanogen chloride by an aqueous solution of chloramine-T, and then upon the addition of a pyridine-pyrazolone solution, a blue colored dye is formed which is stable for at least half an hour. The intensity of coloration, being a function of the concentration of cyanide, is matched in a colorimeter. When colorimeter readings are plotted against concentrations of cyanide, the resulting straight line shows that the colored solution obeys Lambert-Beer's Law.

PRECISION AND ACCURACY OF THE METHODS

I. Modified Liebig Titrimetric Method

This method can be made sensitive to concentrations of free cyanide ion as low as 1 ppm, by the use of the two different end-point indicators. It is suggested that potassium iodide be used as an indicator for titrations of samples containing more than 20 ppm of total CN, and p-dimethylaminobenzalrhodanine for titrations of samples containing more than 1 ppm and less than 100 ppm of total CN.

An analytical determination of the accuracy and the reproducibility of this method and of the distillation procedure was made with the cooperation of five laboratories. Actual solutions obtained either from plating baths or from plating-waste effluents and containing one or two of the metals copper, zinc, cadmium and silver were distributed in well stoppered and completely filled bottles to the laboratories concerned. Most of the analyses were made within a 24-hour period. The results obtained are shown in Table II. The calculation of a mean value for a series of analyses of the same solution was based on values which were not eliminated by Chauvenet's criterion*. The probable error† in most series of analyses was less than 4 per cent.

II. The Pyridine-Pyrazolone Method‡

This method is very specific and accurate. It should be used for analysis of free cyanide in concentrations varying between 0.07 and 1 ppm of cyanide and at

*This is the most generally accepted criterion for rejection of a given reading of a series. A. G. Worthing and J. Geffner, "Treatment of Experimental Data", John Wiley & Sons, Inc., New York (1943), p. 171.

†The probable error, r, of a single measurement of a series is a quantity such that one half the errors of the series are greater than it and the other half less than it. This means that the probability that the error of a single measurement will fall between r and $-r$ 1:2, and the probability that it will fall outside these limits is 1:2.

‡Another method believed to be as satisfactory as the pyridine-pyrazolone method is the benzidine-pyridine method which was originally applied to the analysis of microquantities of cyanides by Aldridge[7]. This method has not been tried by the authors.

*p*H values of 7–9. If the cyanide is present as a complex, the solution should be acidified and distilled.

Substances that do not interfere with this method of analysis: are reducing agents, if present in small quantities, because they are oxidized by chloramine-T; phosphates; chlorides; ammonium salts; borates; sodium salts; cyanates; oxalates; sulfates; ferrocyanides and ferricyanides (below 200 ppm).

The pyridine-pyrazolone method may also be used for the direct determination of cyanogen chloride in the presence of free cyanide, if chloramine-T is omitted.

According to Epstein[1], ferrocyanides and ferricyanides do not interfere with the pyridine-pyrazolone test. Our experimental investigations have shown that ferrocyanides do not interfere if their concentration is less than 200 ppm. In greater amounts, they may interfere enough to cause an appreciable relative error. Thus the presence of 1500 ppm of ferrocyanide in a solution containing 0.067 ppm of free cyanide causes a positive error of 0.07 ppm of cyanide or a relative error of about 100 per cent.

A careful analysis of the readings in Table III shows that the addition of 1500 and 3000 ppm of ferrocyanide ion gives approximately the same colorimetric reading as that of additional 0.07 and 0.14 ppm of CN respectively.

These quantities may correspond to free CN in equilibrium with the ferrocyanide complex ion rather than to cyanide resulting from the chemical decomposition of the ferrocyanide ion by chloramine-T. It is a known fact that the ferrocyanide ion is attacked so slowly by the hypochlorite ion that hardly any decomposition would be expected in the time allowed (1 minute) for the reaction between chloramine-T and the cyanide ion.

A calculation of the amount of cyanide dissociated in distilled water, on the basis of a dissociation constant of 1×10^{-35} at room temperature, indicated that 0.13 ppm of free CN ought to be in equilibrium with 3000 ppm of ferrocyanide. This value is of the same order of magnitude as the experimental value, and the actual difference between the calculated and experimental value could be ascribed to differences in *p*H.

Another explanation for the positive cyanide test obtained in the presence of ferrocyanide, as verified experimentally with reagent-grade ferrocyanide, may be based on the fact that some potassium cyanide may be present in the water of hydration of the potassium ferrocyanide crystals ($K_4Fe(CN)_6 \cdot 3H_2O$). The latter explanation should be preferable to the former because the additional cyanide seems to vary in about the same ratio as the molar ratio of the ferrocyanide ion.

TABLE III. DETERMINATION OF CYANIDE IN ALKALI CYANIDE SOLUTIONS BY THE PYRIDINE-PYRAZOLONE METHOD

Known Conc. of CN ppm	Colorimetric Readings at Ferrocyanide Concentrations of			
	0 ppm		1500 ppm	3000 ppm
	Indiv. Readings	Aver.		
0.067	14.2, 14.2, 12.0	13.4	22.7	31.8
0.13	19.5, 21.5, 19.0	20.0	30.0	38.5
0.20	27.5, 29.8, 30.5	29.3	38.0	46.1
0.26	38.8, 36.6, 38.0	37.8	44.8	52.6
0.33	45.0, 45.5, 45.5	45.3	54.5	62.7
0.40	52.0, 53.5, 53.5	53.0	62.2	69.0

Table IV shows the results obtained in one laboratory using this method for determining cyanide.

I. Modified Liebig Titrimetric Method for Analysis of Cyanides

Apparatus Required

1. Two 50-ml burettes; one 10-ml burette graduated in 0.05-ml divisions
2. Pipettes: 1, 2, 10 ml graduated; 5, 10, 20, 100 ml not graduated
3. Graduated cylinders: 10, 25, 100, 500 ml
4. Volumetric flasks: 50, 100, 200, 500, 1000 ml
5. Erlenmeyer flasks: 25, 50, 125, 250 ml

Reagents Required

1. Standard silver nitrate solutions—0.001-*M*, 0.01-*M*, 0.1-*M*
   Preparation of 0.1-*M* solution: Weigh exactly 16.9890 *g* of $AgNO_3$ crystals (analytical-reagent grade, ACS specification) and dissolve in 500 ml of distilled water. Dilute to 1 liter in a volumetric flask.
   Preparation of 0.01-*M* solution: Dilute 100 ml of the 0.1-*M* solution to 1 liter in a volumetric flask with distilled water.
   Preparation of 0.001-*M* solution: Dilute 100 ml of 0.01-*M* solution to 1 liter in a volumetric flask with distilled water.
   These solutions should be stored in brown bottles.*
2. Potassium iodide solution
   Dissolve 20 *g* of KI in 200 ml of distilled water.
3. Ammonium hydroxide solution—6 *M*
   Dilute 400 ml of concentrated NH_4OH to 1 liter.
4. Sodium hydroxide solution—10 per cent by weight
   Dissolve 20 *g* of cp NaOH in 180 *g* of distilled water.
5. Acetone
6. p-Dimethylaminobenzalrhodanine†—0.02 per cent acetone solution
   Dissolve 0.02 *g* of p-dimethylaminobenzalrhodanine in 100 ml of acetone.

Titrating Procedure

1. *With Potassium Iodide Indicator*
   Add 3 drops of KI solution and 6 drops of NH_4OH solution to 20 ml‡ of distillate in a 50-ml Erlenmeyer flask. If the distillate is expected to contain more than 100 ppm of cyanide, titrate with 0.1-*M* $AgNO_3$ to permanent turbidity. If it contains less than 100 ppm, use 0.01-*M* $AgNO_3$. The observation of the end point can be improved by placing

TABLE IV. ACCURACY OF PYRIDINE-PYRAZOLONE METHOD FOR CYANIDE

Cyanide Added μg/ml	Cyanide Found μg/ml	Relative Error %
0.48	0.53	9.4
0.48	0.51	5.4
0.50	0.53	6.0
0.47	0.49	4.2
0.74	0.78	2.7
0.79	0.83	5.0
0.82	0.84	2.4
0.73	0.74	1.3

*The 0.001-M $AgNO_3$ solution should be prepared fresh every week. The brown bottle in which it is to be stored should have been washed with dilute nitric acid and rinsed with distilled water.

†This compound may be purchased from Eastman Kodak Company, Rochester, N. Y. A one-gram quantity is sufficient for a large number of determinations.

‡Proportionately larger amounts of KI and NH_4OH should be used with samples of larger volumes.

the flask above a black surface, tilting it towards the observer and looking through the solution at the black surface*.

2. *With p-Dimethylaminobenzalrhodanine Indicator*
Add one drop of indicator and one ml of NaOH solution per 10 ml of cyanide sample. Titrate with silver nitrate solution, 0.001- or 0.01-*M* depending on the concentration of the cyanide in the sample to be analyzed, until the yellow coloration decreases in intensity. Add one more drop of reagent. If this drop† causes the solution to become colored with a light red-violet tinge, the silver ion is present in excess and the previous reading should be considered the end point. It is suggested that a blank sample be used consisting of a 2.4 per cent NaOH solution with one drop of indicator per 10 ml of solution. The yellow coloration of the blank will fade upon prolonged standing, and a new blank must be used.

Calculations

To calculate the concentration of cyanide in parts per million (ppm) the following equation should be used:

$$\text{ppm CN} = \frac{\dfrac{\text{ml of } AgNO_3 \times 2 \times \text{molarity of } AgNO_3 \times 0.026 \times 10^6}{\text{ml of sample} \times \text{density of sample in g/ml}}}{\text{where F}} \times F$$

$$\text{where F} = \frac{\text{volume of diluted distillate}}{\text{volume of aliquot}}$$

If the distillate is analyzed "in toto", F = 1

Because the density of the sample can be assumed to be 1 g/ml, the following simplified formula may be used:

$$\text{ppm CN} = \frac{\text{ml of } AgNO_3 \times \text{molarity of } AgNO_3 \times 52{,}000}{\text{ml of sample}} \times F$$

II. Pyridine-Pyrazolone Colorimetric Method

Apparatus Required

1. Pipettes: 1, 2, 10 ml graduated; 5, 10, 20, 100 ml not graduated
2. Graduated cylinders: 10, 25, 100, 500 ml
3. Volumetric flasks: 50, 100, 200, 500, 1000 ml
4. Round-bottom flask: 250 ml
5. West or Liebig water-cooled condenser
6. Evaporating dish: 250 ml
7. Glass-stoppered bottle: 1-oz size
8. Electric hot plate
9. Test tubes: 22 × 175 mm
10. Colorimeter with accessories. Investigators used Klett-Summerson Colorimeter with No. 66 filter, which transmits a light band with mean wavelength of 660 millimicrons, and Evelyn Photoelectric Macro-Colorimeter with No. 580 filter, which transmits a light band with mean wavelength range of 565-610 millimicrons.

Reagents Required

1. Chloramine-T aqueous solution—1 per cent by weight
Dissolve 1 g of chloramine-T in 100 ml of distilled water.
2. 1-phenyl-3-methyl-5-pyrazolone‡—commercial grade
3. Pyridine—ACS standard-specification grade
4. Phenylhydrazine
5. bis-(1-phenyl-3-methyl-5-pyrazolone)
17.4 g of twice recrystallized¶ 1-phenyl-3-methyl-5-pyrazolone are dissolved in 100 ml of 95 per cent ethyl alcohol. Twenty-five g of freshly distilled phenylhydrazine are added and the mixture refluxed for at least four hours. The insoluble portion which is filtered off and washed with hot alcohol is bis-(1-phenyl-3-methyl-5-pyrazolone).
6. Pyridine-pyrazolone reagent.
Commercial pyrazolone is added to 100 ml of distilled water until the solution becomes saturated§. To this solution is added 20 ml of pyridine in which 0.02 g of bis-pyrazolone has been dissolved. The pyridine-pyrazolone reagent should be prepared fresh every day, because it loses some of its effectiveness after a day's standing**.
7. Sodium cyanide—analytical reagent grade, ACS specification
8. Standard cyanide solutions—1000 ppm and 1 ppm CN
A cyanide solution containing 1000 ppm of CN is prepared by dissolving 1.96 g of sodium cyanide in enough distilled water to make 1 liter of solution. This solution may be used as a stock solution for one week if it is well stoppered.
A standard solution containing 1 ppm of CN is prepared by diluting 1 ml of the above-mentioned solution to 1 liter in a volumetric flask. This solution should be made fresh whenever it is needed.
9. Boric acid solution—0.75 *M*
Dissolve 9.3 g of ortho-boric acid in 100 ml of distilled water at about 50° C and dilute to 200 ml in a volumetric flask.
10. Copper sulfate, pentahydrate, $CuSO_4 \cdot 5H_2O$—reagent grade
11. Preparation of artificial permanent color standard
In the absence of a photoelectric colorimeter, copper sulfate solutions may be used as color standards to give cyanide concentration readings to the nearest 0.1 ppm. These

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*The observation of the end point can be aided further by passing a small beam of light through the solution. When the end point has been reached, the colloidal particles of AgI will cause the light beam to be scattered, thus creating the so-called Tyndall effect.

†A proportionately greater number of drops of 0.001-*M* $AgNO_3$ will be necessary to cause a color change in larger volumes of samples.

‡This reagent may be purchased either from the Eastman Kodak Company or the Dow Chemical Company.

¶The following procedure is used to recrystallize commercial 1-phenyl-3-methyl-5-pyrazolone: 40 ml of 95 per cent ethyl alcohol are placed in an evaporating dish and heated to about 50° C. Enough commercial pyrazolone is slowly added, with stirring, to saturate the alcohol and provide a slight excess. Then 5-10 ml of alcohol are added. The solution is allowed to cool to or below room temperature in an ice bath. It is then filtered and the filtrate discarded. The crystals are recrystallized once more, following the same procedure but using less alcohol. After the second filtration, the crystals may be dried of most of their alcohol content by first placing them between filter papers, and then air drying them in an evaporating dish.

§The following procedure is used to prepare a saturated solution. 0.5 g of pyrazolone is added to 100 ml of distilled water. The solution is heated to about 60° C with stirring. The water evaporated in the process is replaced, and the solution is filtered after having been cooled to room temperature.

**It has been found that the coloration which develops in the pyridine-pyrazolone reagent upon standing is primarily due to oxidation. The elimination of oxygen by addition of sodium sulfite prevents coloring of the reagent, but sodium sulfite has a tendency to bleach the color formed by reaction between pyridine-pyrazolone and cyanide, even if added in very small quantities, and retards the oxidation only briefly. The extent of the deterioration of the reagent affects the time necessary for attainment of the final blue coloration by reaction with cyanide, and sometimes this blue coloration is never attained. It is possible to delay deterioration of the pyridine-pyrazolone reagent, and to save time and chemicals, by (1) using pyridine-(bis)-pyrazolone and an aqueous pyrazolone solution separately (the latter does not lose its effectiveness upon several days' standing) and (2) by *adding to the cyanide sample first the aqueous pyrazolone solution and then the pyridine-bis-pyrazolone solution.* The pyridine-(bis)-pyrazolone reagent will lose most of its effectiveness in 4-5 hours even if stored in a brown bottle. However, if these solutions are stored in a refrigerator, their stability may be increased considerably.

standards may be kept in ordinary test tubes (22 x 175 mm) and sealed to prevent loss of water vapor. They are prepared as follows: 8.375 g of $CuSO_4 \cdot 5H_2O$ are dissolved in 50 ml of distilled water and diluted to 100 ml in a volumetric flask.

A series of standards of ten stepwise increasing color intensities are prepared by diluting 1–10 ml of the above solution to 10 ml in increments of 1 ml. These ten color standards correspond to cyanide concentrations varying between 0.1 and 1 ppm of CN in increments of 0.1 ppm.

12. Preparation of standard colorimetric curve
    (a) To each of five glass stoppered 1-oz bottles add 0.2, 0.4, 0.6, 0.8, 1.0 ml of cyanide standard solution (1 ppm). Dilute each solution to 2 ml with distilled water.
    (b) To each bottle, add 0.2 ml of the chloramine-T solution, stopper the bottle immediately, and shake it.
    (c) One minute later add 3 ml of the pyridine-pyrazolone reagent, stopper the bottle, and shake it.
    (d) Prepare the blank in the manner described in steps (a) and (b), omitting the pyridine-pyrazolone reagent and adding in its place 3 ml of distilled water.
    (e) Twenty minutes later transfer the solution to a tube fitted to the colorimeter and take the readings by setting the instrument to read 100 per cent light transmission with the blank.
    (f) Prepare a standard colorimetric curve by plotting on a semilog paper the reciprocal of the colorimetric reading times 100 in the ordinate *vs.* the concentration of the standard samples in ppm of CN in the abscissa. The curve should be a straight line.

Operating Procedure

A. Determination of cyanide in an unknown sample by using a colorimeter.
   1. Dilute the distillate to 100 ml with distilled water in a volumetric flask.
   2. To a 1-ml sample, add 1 ml of boric acid solution and 0.2 ml of chloramine-T solution. Stopper the bottle immediately and shake it.
   3. One minute later add 3 ml of the pyridine-pyrazolone reagent*, again stopper the bottle and shake it.
   4. Prepare a blank as in 12 (d).
   5. Twenty minutes later transfer the solution to a colorimetric tube and take readings with a colorimeter, as in 12 (e).
   6. Check the colorimefer reading obtained for each sample on the standard colorimetric curve and determine the concentration of cyanide in the sample by reading the abscissa.

B. Determination of cyanide in an unknown sample by using copper sulfate standards
   1. Repeat steps A1, A2 and A3.
   2. Twenty minutes later transfer the solution to a 22 x 175-mm test tube.
   3. Match the intensity of coloration developed in each sample against the coloration of the copper sulfate standards to determine the concentration of cyanide in the unknown sample.

Calculations

The concentration of cyanide in the original sample is determined as follows:

$$\text{ppm of CN} = \frac{\text{ppm of CN in diluted distillate} \times 100}{\text{ml of original sample}}$$

*If saturated aqueous pyrazolone and pyridine-(bis)-pyrazolone solutions are added separately, 6.4 ml of the former and 1.6 ml of the latter should be added in the order given.

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The Conrad Hilton Hotel (largest hotel in the world) will serve as headquarters of the Convention, June 16-20. Its fabulous ballrooms, well appointed meeting rooms and famous dining facilities will furnish the background. The International Amphitheatre, site of the Third Industrial Finishing Exposition, held simultaneously, and the Stock Yard Inn, where the educational sessions will be held, are also world famous. And in line with the progressive spirit of the Society we have new things to look forward to.

Michael DiSalle to Speak

Chairman Clyde Kelly has announced that Michael DiSalle, who recently retired from the post of Director of the Office of Price Stabilization, will give the keynote address at the opening of the Convention. Mr. DiSalle has close connections with the plating industry.

The Educational Program

There will be an experiment with dual sessions on Monday afternoon. If the reaction is favorable, it will be continued in subsequent conventions.

The morning educational sessions will begin at 9:00 A. M., and the dual afternoon session on Monday afternoon at 2:00 P. M.

McKinlock Court with Carl Milles Fountain of the Tritons, setting for the Aunt Ella Society's Garden Party-Luncheon. Courtesy The Art Institute of Chicago

Men of outstanding ability and wide reputation have accepted invitations to deliver papers of timely interest, among them Fred Brune, Dr. Russell Harr, W. S. Morrison and L. Gilbert, Myron Ceresa, L. A. Dause, Fred Keller, Harold Faint, Dr. Harold Wiesner, Frank Savage, W. L. Pinner and Dr. W. R. Meyer.

One general subject to be treated is "Materials of Construction", which will include papers on

"Materials for Waste Water Treatment"
"The Plating Department of Western Electric Company's New Indianapolis Plant", and
"Plastics in the Plating Room"

Other papers will deal with such important subjects as

"Use of Ion Exchange Systems in the Recovery of Chromic Acid Waste"
"Reducing Contamination of Waste Liquors"
"Substitute Finishes"
"Hard Coatings on Aluminum"
"Practical Filtration"
"Plating of Heavy Rhodium Coatings"
"Instrumentation in the Plating Room"
"Effect of Mechanical Abrasive-Grain Polishing on Corrosion Resistance of Subsequent Coatings", and
"Black Nickel Coatings"

In addition a movie by G. W. Jernstedt of a visit to the Westinghouse Electric Corporations' plating research laboratory will be shown.

The Thursday morning session will be devoted to reports from the A. E. S. Research Committee.

All who attend the educational sessions will carry home many ideas that can be put to practical and profitable use.

Ladies' Program

The ladies have a double incentive for coming to the Convention this year. Mrs. Marion Longfield and her committee not only have arranged a program of unusual interest but have also added a new feature. During the opening session one of the ladies attending the Convention will be chosen Queen to preside at all functions in which the ladies participate. All ladies have an equal chance to win this honor. A card will be deposited for each lady as she registers. From these will be drawn three cards, the first for the Queen, the

(Continued on page 309)

J. M. Andrus, Educational Chairman

Mrs. Marion Longfield, Ladies' Chairman

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Washington Orders

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Allotment and DO numbers and symbols.—The DPA revised its list slightly on January 11.

Copper.—The procedure for self-authorization by which small users can obtain copper was tightened by an amendment to CMP Regulation 1, Direction 1, dated January 5.

CMP Regulation 1 was itself twice amended on January 5 to permit users to charge a delayed shipment of copper to the originally scheduled quarter, and to provide that manufacturers of "Class B" products must not use copper in inventory in addition to the quarterly allotment unless expressly authorized to do so.

An amendment of January 23 to copper Order M-11 redefined "brass-mill products" to include anodes, rolled, forged or sheared from cathodes. Other revisions brought the order up to date but did not change the rules.

The various products in Schedule I of Order M-47B, Consumers Durable Goods, were regrouped in an amendment dated January 15 to agree with current allotments.

Order M-97, Lighting Fixtures, issued on February 4, restricted the use of copper to specified parts, but permitted the copper plating of such fixtures.

Fifteen thousand eight hundred tons more of copper, about 1 per cent of the U. S. annual consumption of about 1,400,000 tons, will be made available from Canada this year.

Job-shop meeting.—The Electroplating Industry Advisory Committee, which represents an estimated 3,500 firms, of which a majority employ less than 10 men, at its meeting on January 20 stated that the job shops can maintain themselves on 15 per cent of their base-period use of nickel anodes by employing thinner coatings. They cannot, however, obtain needed nickel even for permitted operations under Order M-80, although large quantities of nickel were said to be offered by black-market sources.

The committee asked (1) that Order M-80 be liberalized, be clarified to place responsibility for conformity to end-use restrictions upon the contractor, and be revised to permit replating service, (2) that the job-shop industry's requirements be restudied, (3) that DPA in granting certificates of necessity to manufacturers give due regard to the job-shops' needs for orders.

Lead.—Recent softening in the world market for lead has made it possible to import the metal under more favorable conditions.

Small business.—A firm classified as small business according to the recent Department of Commerce study may now obtain assistance from a Small Business Hardship Account of Controlled Materials *if* it is a single-line producer *and* is faced with failure or prolonged shutdown owing to lack of sufficient controlled materials *and* if plant facilities cannot be converted because it would require substantial investment or extensive retooling.

Certain functions of the Office of Small Business, NPA, have been transferred to the Small Defense Plants Administration.

Copies of "Basic Tax Information for Small Business" are available free from the Division of Printing Services, U. S. Department of Commerce, Washington 25, D. C., and from all Department of Commerce field offices.

Tin.—By agreement, the United Kingdom will deliver 20,000 long tons of tin to the U. S. during 1952.

Zinc.—Canada will increase its shipments of zinc to the U. S. by 31,700 tons in 1952. This is about 3 per cent of U. S. 1951 consumption of 1,064,000 tons.

Zinc oxide is now in fair supply, according to a report from a meeting of the Paint Industry Technical Committee with NPA officials.

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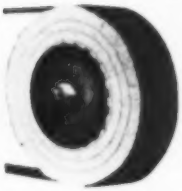

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Book Review

DR. HAROLD J. READ

Professor of Metallurgy, Pennsylvania State College

HANDBUCH DER METAL BEIZEREI (Vol. I, Nonferrous Metals) by Otto Vogel, 2nd edition revised by Hermine Vogel, 1951, xv + 410 pages. Verlag Chemie GMBH. Weinheim/Bergstr., Germany. Price, DM 49.20.

It is unfortunate that there is no English translation of this book on the pickling of metals, for there is nothing like it in the English language. The late Otto Vogel and his daughter Hermine, assisted by K. Kaiser, H. Krause and F. Sierp, have compiled a unique volume which can well serve as a complete source book for all of those interested in the acid treatment of metals.

The book is divided into two parts, the first of which comprises about one-third of the volume and is devoted to matters of general interest. After tracing the historical development of pickling processes, the authors discuss the general nature of suitable equipment and plant installations. Specific details along these lines are reserved to later chapters where treatments for the individual metals are given in great detail. Waste disposal problems are discussed rather fully. Several chapters deal extensively with health problems, occupational diseases and accidents which may occur in the pickling plant.

The practical part of the text consists of several chapters, each of which is devoted to an individual metal, or a class of metals. In each chapter the requirements for pickling as dictated by such variables as alloy composition, physical form and metallurgical history of the metal are treated in great detail along with full discussions of all the known pickling baths which are applicable to specific metals and alloys.

The text is replete with literature citations in spite of the fact that the volume itself is extremely complete even to minute details. In addition to the specific citations many of the chapters are concluded with lists of books and journal references for further reading. There is every evidence that even the most recent literature has been culled with the thoroughness that we usually expect of German authors. There are many references to articles and books published as late as 1949 and 1950. The beautifully printed book is illustrated with 263 line drawings and photographs, most of which are extremely helpful to the reader, and many curves showing rate of metal loss as a function of time, temperature or solution composition are very useful.

A table at the end of the book lists the colloquial or trivial German names for many chemicals along with their scientific names, and the subject index is wonderfully complete.

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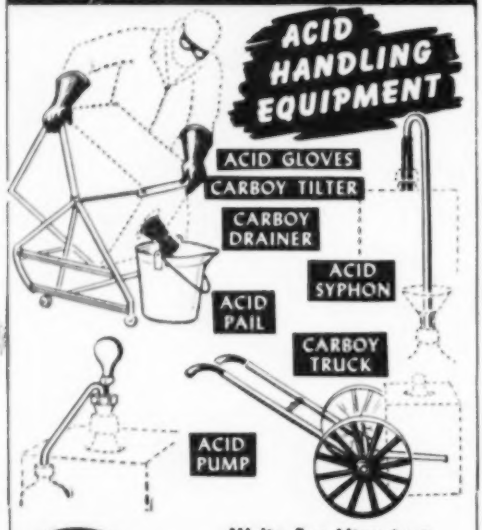

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readers' questions of general interest

Q. 135 on cleaning and zinc plating heat-treated steel spring clips. (*See January, 1952, issue.*)

A. The following procedure has given good results on retaining rings: (1) Place the rings in a basket and soak clean for about 5 min; (2) rinse twice, and dip in inhibited 50 per cent muriatic acid until the scale has loosened (about 1 min); (3) tumble for 45 min in an oblique barrel with pumice stone and a little cleaner in water; (4) rinse in cold water and repeat the cycle; (5) rinse in cleaner and water, acid dip quickly and again rinse in water; (6) place in cyanide for 5 min; (7) plate in a bright-zinc solution with *no* excess of brightener and at not too high a current.—N. ANANIATIS.

Q. 137. What is a good gold solution for plating radar wave guides, from 0.5 x 1 x 36 inches long to 2 x 4 x 132 inches long? The guides are first silver plated to a thickness of about 0.0003 inch and should then be flashed with a light-colored gold of good depth.

A. I assume that the problem of uniform deposition of the silver has been solved by the use of inside anodes and pumping of the solution through the tube. The use of such equipment should make it rather easy to apply the gold.

A minimum of 0.000003 inch of 24K gold must normally be applied on a highly finished silver surface in order that a gold color remains after initial diffusion has taken place; thinner coatings result in a brown, stained surface. As the silver finish becomes matter, a thicker coating is required.

We recommend for a 0.000003–0.00001 inch coating a solution containing 5 dwt/gal (2 g/l) gold as $KAu(CN)_2$ and 2 oz/gal (15 g/l) of each free potassium cyanide, potassium phosphate and potassium carbonate, operated at 150–160° F and 10–15 asf with 18-8 stainless-steel or platinum anodes.—E. A. PARKER.

Q. 138. How can I prevent the formation of ferrocyanides from steel ball-anode containers in a low-pH bronze solution? Would rubber coating of the greater part of the container help?

A. The real source of your difficulty is probably the presence of chlorides from dragged-in muriatic acid pickling solution or chlorinated solvent. Improvement in the rinsing prior to plating is indicated.

The use of partly rubber-coated steel containers is likely to cause the corroding current to concentrate on the bare areas. In some work with completely rubber-coated containers, contact was established to the top ball above the solution level. Very high contact pressure and frequent adjustment to maintain contact throughout the stack of balls appeared necessary.—K. G. SODERBERG.

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Article Abstracts

No copies of articles are available at the offices of "Plating". Photostats may be had from libraries having files of the journal in question and offering photostat service, usually at 30-50 cents a page. Ask your public library to consult the Union List for names of libraries having the particular journal. Abbreviations used are those of Chemical Abstracts.

How To Reduce Pickling Brittleness in Stainless Steels. Carl A. Zapffe. Materials & Methods **32**, 74-77 (November, 1950).

In a previous article (October, 1950), the fundamental nature and causes of embrittlement in steel due to acid pickling were explained. In this article, practical application of this knowledge to the avoidance or reduction of pickling brittleness is described. Use of pickling inhibitors, surface-active agents, a foaming compound (negative results), and molten-caustic pickling is discussed, also, at some length, the aging and recovery process for removal of hydrogen from steel.

Investigation of Some Pickling Inhibitors. S. A. Balezin and S. K. Novikov. Zhurnal Prikladnoi Khimii **24**, No. 3, 283–288 (1951). Transl. No. 2747, Henry Brutcher, Altadena, Calif.

Formaldehyde and hexamethylene tetramine in sulfuric acid pickling of steel and thiodiglycol in hydrochloric acid pickling of steel act as inhibitors and as accelerators, the former dominating at low concentrations of the "inhibitors". The inhibition of thiodiglycol, which is pronounced in sulfuric acid pickles, is poor in hydrochloric acid pickles. 15 refs.

Anodic Polishing and Its Relation to Anodic Passivation. Kurt Huber. Z. Electrochem. **55**, 165-169 (1951). Chem. Abs. **45**, 7447 (September 10, 1951).

The conditions for anodic polishing, previous theories, analysis of current-potential curves, surface conditions of anodically polished metals, and mechanisms of anodic polishing are discussed. It is concluded that the metal surface was oxidized under polishing conditions and thus rendered passive. In the fluid anode film, diffusion processes controlled the rate of removal

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Article Abstracts

and reforming of this oxide layer on the metal. Analysis of the current-potential curve revealed the properties which the electrolyte had to have to serve as a polishing bath.

High-Purity Aluminum-Magnesium Alloys for Anodic Polishing. J. Herenguel. Met. Ital. **43**, 72-73 (February, 1951).

Pure aluminum, although capable of taking high-grade anodic polishing, is limited in practical application because of its poor mechanical characteristics. A moderate addition of magnesium in amount below the limit of solid solution will raise the strength of the metal to a point suitable for technological use. At the same time, however, care must be taken to prevent conditions that may lead to a nonuniformity of the anodic coating, such as phase precipitation, macroscopic segregations, preferential orientation, and coarse grain. The principal means of controlling those factors are selection of proper composition and heat-treatment prior to anodizing. A French alloy called "Brillalumag", containing approximately 3 per cent magnesium, has proved successful in large-scale production.

Electrodeposition of Thallium and Thallium-Lead Alloys. E. Bertorelle, L. Giuffre and A. Tunesi. Chimica e industria (Milan) **32**, 517 (November, 1951).

Following a literature review, the authors show that compact thallium deposits may be had in solutions containing 150 g/l (20 oz/gal) thallium fluoborate ($TlBF_4$), 16.9 g/l (2.25 oz/gal) fluoboric acid (HBF_4), 5 g/l (0.7 oz/gal) aloin, 10 g/l (1.3 oz/gal) of each peptone and creosol, at a current density of 0.1–0.15 amp/dm² (1–1.5 asf). Compact alloys of the two metals may be had from solutions containing 0.59 mol/l of thallium plus lead fluoborate, 26.7 g/l (3.7 oz/gal) free HBF_4, 5 g/l (0.7 oz/gal) aloin at 1.3 amp/dm² (12 asf) and room temperature. With 30, 50, 58 and 78 mol per cent of the thallium in the bath and in the anodes, the deposit contains about 31, 51, 56 and 77 per cent, respectively. The alloy anodes corrode smoothly. 16 ref.

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Patent Abstracts

GEORGE B. HOGABOOM

Consultant, New Britain, Conn.

Copies of patents may be obtained by writing to Commissioner of Patents, Washington 25, D.C. Price 25 cents each.

No. 2,571,709, October 16, 1951—Apparatus for Electroplating Articles—Alvin N. Gray, assignor to Western Electric Company.

CLAIM. An apparatus for copper plating steel wires, which comprises a container, a copper pipe extending along the container, a drain fitting composed of electrically insulating material secured to one end of the pipe and having an opening in alignment with the pipe through which a steel wire to be plated may extend in close-fitting relationship, said fitting having a channel for directing liquid from the pipe, a supply fitting composed of electrically insulating material secured to the other end of the pipe and having an opening in alignment with the pipe through which the steel wire may extend, said supply fitting also having a channel for directing liquid to the pipe, a supply pipe connected to the supply fitting and supporting the supply fitting, the copper pipe and the drain fitting in positions out of contact with the container for supplying electrolyte to the copper pipe, electroconductive wire-stretching elements connected to and electrically insulated from the walls of the container for supporting the steel wire in a position centered for creating a difference of potential between the copper pipe and the wire-stretching elements.

1 claim, 3 figures, 3 examples.

References cited: U. S. Patents 28,590; 1,068,411; 1,322,494; 1,476,284; 1,731,269; 1,886,218; 1,927,162; 2,392,687. French Patent 667,252.

No. 2,572,219, October 23, 1951—Method of Processing Electroplated Spring Steel Parts—K. B. Valentine, assignor to General Motors Corporation.

CLAIM 3. The method of processing parts formed of hardened and tempered spring steel having a Rockwell C hardness of 50–56 which comprises heating the spring steel at a temperature of 1100° F to 1200° F for a time of about two hours, slowly cooling the steel, then heating the spring steel at a temperature within the range of about 1500° F to 1650° F to austenize the same, quenching said heated spring steel to harden the same, tempering said hardened steel by heating to a temperature within the range of 400° F to 750° F, electrodepositing onto said hardened and tempered spring steel a coating of the class consisting of zinc and cadmium, and then heating said hardened and tempered steel part and electrodeposited coating thereon at a temperature of about 400° F for a time of about four hours.

CLAIM 4. The method of processing lock washers formed of spring steel having a Rockwell C hardness after hardening and tempering within the range of 50–56 which comprises heating the spring steel at a temperature of 1100° F for two hours, slowly cooling the steel, thereafter heating the steel to a temperature within the range of 1500° F to 1650° F to austenize the same, quenching the steel to harden the same, tempering within the range of 400° F to 750° F, electrodepositing a coating of zinc having a thickness of 0.0002 inch to 0.0005 inch onto the hardened and tempered steel part, and thereafter heating the plated steel part to a temperature of 400° F for four hours.

4 claims, 1 table.

References cited: U. S. Patents 1,072,091; 1,383,175; 1,838,273; 2,406,683. Trans. Am. Soc. Steel Treating, 237–239 (August, 1926). "The Metallography and Heat Treatment of Iron and Steel", by Sauveur, 4th ed. (1935), pp. 292, 293. "The Making, Shaping and Treating of Steel", by Camp and Francis, 5th ed. (1940), p. 357.

No. 2,572,838, October 30, 1951—Method and Apparatus for Electrolytic Treatment of Slide Fasteners—C. C. Cohn, assignor to Samuel L. Cohn and Charles C. Cohn, Colonial Alloys, Philadelphia, Pa.

CLAIM 4. The method of electrolytically coating closed zippers formed of metal elements clamped on nonconducting carriers comprising locating a closed zipper across at least one face of a metallic frame including a series of elongated members extending in substantial parallelism to provide a lattice, the zipper extending transversely across said elongated members, associating with said frame a second separate metallic frame including a series of elongated members extending in substantial parallelism to provide a lattice so that the members of the second frame project between the members of the first mentioned frame and impart to the closed zipper a sinuous configuration to produce a stressed engagement between the metal elements thereof, and subjecting the resulting assembly to an electrolytic action involving current conduction through the series of metal elements and thereby coating the metal elements of the zipper.

4 claims, 3 figures.

References cited: U. S. Patents 196,098; 1,970,458; 1,983,070; 2,106,012; 2,137,819; 2,245,335; 2,275,194; 2,334,054. British Patents 449,289; 511,922.

No. 2,575,712, November 20, 1951—Electroplating—G. W. Jernstedt, assignor to Westinghouse Electric Corporation.

CLAIM 5. The process of electroplating on a base member a metal selected from the group consisting of copper, brass, silver and zinc from a liquid electroplating electrolyte having dissolved therein as the sole platable metal a metal from said group that may be plated on the base member when the base member is the cathode and readily deplated from the base member and put into solution in the electrolyte when the base member is the anode, comprising the steps of

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Gallon Cap.	Inside Diam.	Inside Height	List Cost
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3½	11"	9"	$7.50
5	11"	12"	9.50
15	15"	20"	17.50
20	18"	20"	24.50
30	18"	27"	29.50
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connecting the base member into an electroplating circuit including the electrolyte, causing electric current to flow in the electroplating circuit to make the base member cathodic to electroplate metal from the electrolyte on the base member for a period of time of between 2 and 40 seconds, then at the end of the period of time discharging through the base member and the electrolyte a condenser having a capacity of from 0.1 to 10 microfarads charged to a potential of from 30 to 1000 volts to render the base member anodic during the discharge whereby to deplate a portion of the electroplated metal, and continuing to make the base member cathodic by connecting it into the electroplating circuit and to make the base member anodic by discharging the condenser therethrough until a desired thickness of metal has been electroplated on the base member.

5 claims, 5 figures.

References cited: 1,260,661; 1,428,050; 1,534,709; 1,712,284; 1,785,389; 2,063,760; 2,181,773; 2,451,341.

No. 2,576,074, November 20, 1951—Method and Apparatus for Continuous Strip Metal Treatment—J. S. Nachtman.

CLAIM 9. A method of electroplating a continuous length of metal strip, comprising essentially the steps of supplying metal strip in discontinuous lengths, welding lengths of strip together end to end with good contact between successive lengths to form a continuous strip, then forming a storage loop of continuous strip, then cleaning the continuous strip, then electroplating the cleaned continuous strip, then cleaning the electroplated strip, pulling said strip through said first cleaning, electroplating and second cleaning steps continuously and at substantially constant speed, stopping the portion of said strip being joined during the welding operation while withdrawing strip from said storage loop, applying drag-tension to said strip between the supply and the first cleaning operation, continuously moving the strip through the first cleaning, electroplating and second cleaning operations under predetermined tension and cutting the cleaned electroplated strip into predetermined lengths while continu-

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PARTIAL LIST

Amps.	Volts	Make	RPM
10,000	2/6	H. V. W.	450
10,000	2/10	J. & L.	400
4,000	7 1/2	Northern	360
4,000	6/12	Chandy.	450
3,500	6/12	Meeker	600
3,000	6	Conn.	720
2,500	6	American	600
400	12	Hertner	1750
1,500	15	Star	1180
1,000	18	G.E.	720
1,200	24	G.E.	720
1,500	26	Century	900
600	28	West.	600
1,500	32	G.E.	1200
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3,000	5/50	Century	1200

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Patent Abstracts

ously moving said strip through first cleaning, electroplating and second cleaning operations.

9 claims, 3 figures.

References cited: 1,120,191; 1,242,695; 1,517,910; 1,533,447; 1,811,522; 1,928,409; 1,991,817; 2,007,614; 2,009,856; 2,052,255; 2,066,565; 2,075,332; 2,076,969; 2,201,117; 2,238,667; 2,240,265; 2,266,330; 2,325,401; 2,459,674. British Patent 279,787. German Patent 427,436.

No. 2,576,922, December 4, 1951—Electrodeposition with Nickel—E. L. A. Camin, S. E. Hybinette and H. B. Taylor, assignors to Kenmore Metals Corporation.

CLAIM 1. A method for producing a highly ductile nickel plating on a metal base which comprises passing a current of less than 250 amperes per square decimeter from a nickel anode to a metal base to be plated through a bath formed essentially from a nickel compound, hydrofluoric acid, boric acid and water, said hydrofluoric acid reacting with said nickel compound to form a complex nickel fluoride, said hydrofluoric acid being present in a quantity in excess of that required to convert said nickel compound to said complex nickel fluoride, said bath containing at least 30 grams of nickel metal per liter, and 20–60 grams of boric acid per liter, said excess of hydrofluoric acid giving said bath a *p*H of more than 1 and less than 6, the anions of said bath comprising essentially fluorides and borates.

12 claims, 12 examples.

EXAMPLE II

Nickel	75 grams per liter
Boric acid	35 grams per liter
Current density	1–250 amp/dm²
Temperature	50° C
*p*H	4.2–4.7

References cited: U. S. Patent 2,313,756. Trans. Electrochem. Soc. 15, 461, 465 (1909); 23, 145, 146, 147 (1913); 39, 460–481 (1921); 81, 213–229 (1942).

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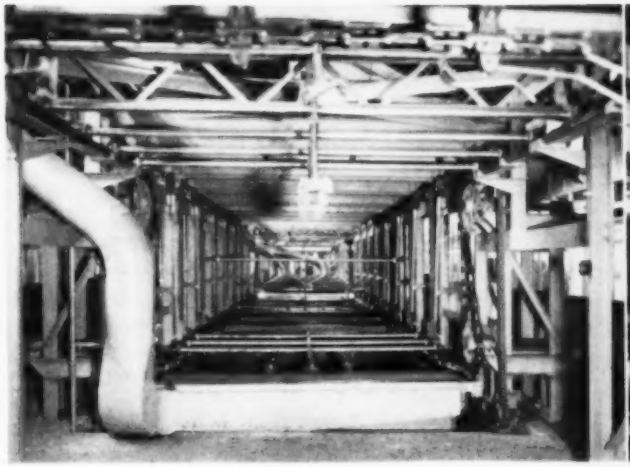
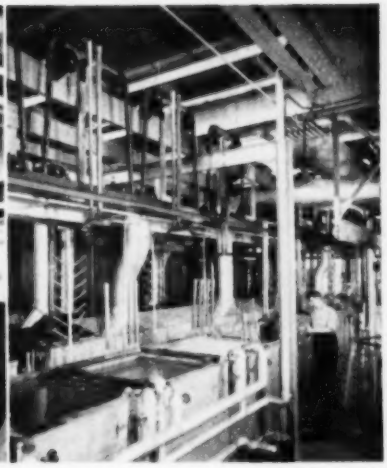
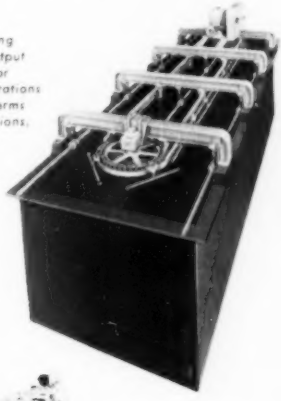


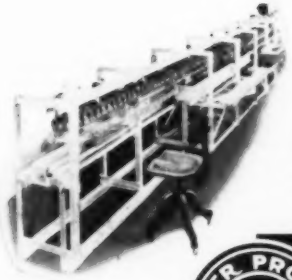
Typical Meaker Straight A-Way Automatic Plating Machine. This type unit is designed to handle 125 racks or more per hour.



Meaker Return-Type Automatic Plating Machine for chromium plating the large variety of parts in a high-quality line of plumbing hardware. Machine may be designed to copper plate, nickel plate and chromium plate in one continuous line.

A Meaker Semi-Automatic Plating Machine for use in medium-output plating departments and also for supplementing the plating operations in a Full Automatic which performs the cleaning, preplating operations, final rinsing and drying.





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No. 2,576,997, December 4, 1951—Acid Zinc Electroplating and Electrolyte Therefor—Allan E. Chester, assignor to Poor & Company, Chicago, Ill.

CLAIM 12. A method of producing a bright zinc plate which comprises electrodepositing zinc from an acid zinc sulfate plating bath containing lactic acid and an alkylated naphthalene sulfonate in quantity effective to produce a bright plate when plated article is subjected to a secondary treatment with an oxidizing acid, and thereafter subjecting said plated article to said secondary treatment.

12 claims, 4 examples.

References cited: U. S. Patents 570,554; 694,658; 967,200; 1,818,229; 2,227,508; 2,245,086; 2,451,426; 2,452,003; 2,485,563. "Metallische Ueberzuege", by Willi Macher, 2nd ed., J. W. Edwards (1945), p. 235.

No. 2,576,999, December 4, 1951—Method of Electroplating Zinc—A. E. Chester, R. F. Main and H. F. Hansen, said Main and said Hanson assignors to Acme Steel Company, said Chester assignor to Poor & Company.

CLAIM 7. A method of electroplating zinc which comprises continuously electrodepositing zinc on a continuously moving metal strip, sheet or wire as a cathode from an aqueous acid bath having a *p*H within the range of 1.0 to 5.5 consisting essentially of dissolved zinc sulfate, zinc gluconate and isopropyl naphthalene sodium sulfonate, said bath having a zinc content within the range of 50 to 150 grams per liter of solution, a lead content below 5 milligrams per liter of solution, a zinc gluconate content within the range of 25 to 80 grams per liter of solution, and an isopropyl naphthalene sodium salt content within the range of 1.5 to 2.5 grams per liter of solution, and maintaining the temperature between 100 degrees F and 160 degrees F.

7 claims, 6 examples.

References cited: U. S. Patents 694,658; 905,837; 1,818,229; 2,451,426; 2,485,563.

No. 2,577,833, December 11, 1951—Process for Electrowinning Chromium—George Westby, assignor to United States of America as represented by the Secretary of the Interior.

CLAIM 2. In a process for electrowinning of chro-

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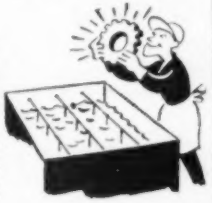
TIPS FOR BETTER PLATING—FROM DU PONT

Answers to your questions . . . suggestions for improving techniques

IN THESE CRITICAL TIMES, the efficient use of plating materials and increased production from existing plating units are problems of the utmost importance. The questions shown on this page are typical of those being asked by platers in their letters to Du Pont. Perhaps the answer to *your* plating problem is printed here. If not, write directly to Du Pont Plating Service, Electrochemicals Department, E. I. du Pont de Nemours & Co. (Inc.), Wilmington 98, Delaware.

Q. My copper plating bath produces deposits with dull and bright areas which cannot be used for subsequent plating or buffing. I suspect chromium contamination from carry-over of chromic acid into bath on plating racks. How can I correct this condition?

A. Sodium hydrosulfite can be used to reduce chromium compounds to the less harmful trivalent state. It should be added in amounts equivalent to 2 oz. 1000 gals., and its effect should be noted before further addition. Sometimes the quantity of hydrosulfite must be increased up to 1 lb. 1000 gals. or more to correct chromium contamination. In all cases, each addition should be small, since excess hydrosulfite can produce deposits that are rough, dull and non-uniform.



Q. We are cadmium plating parts with non-uniform sections and extremely irregular surfaces. Uniformity of deposit thickness is required, but we have been unsuccessful in using a standard formulation plating bath. What do you suggest?

A. Highest throwing power with maximum uniformity of cadmium deposit can be obtained with the following formulation: "Cadalyte" Salts, 12.0 oz. gal., Sodium Cyanide, 8.0 oz. gal. This produces a bath containing:

Cadmium Metal	2.25 oz. gal.	Ratio Na CN: Cd	7.5: 1.0
Total Sodium Cyanide	17.0 oz. gal.	Caustic Soda	1.5 oz. gal.
		"Cadalyte" Brightener	0.36 oz. gal.

This bath may be used at an average current density of about 10 A/SF.

Q. I have a steel plating tank which is currently being used for cadmium. What precautions should I take in converting this tank to cyanide zinc plating?

A. Before the zinc plating bath is prepared, the tank should be thoroughly cleaned in the following manner:

1. After removing all anodes and solution from the tank, use a solution containing 2 oz. gal. sodium cyanide and 2 oz. gal. caustic soda. Then make the tank itself anodic and electrolyse on dummy cathodes under 2 volts for 24 hours. Normal metal residue on the sides of the tank will be removed in this period, but heavier deposits may require mechanical removal. (***CAUTION.*** *Do not "burn off" cadmium. The fumes from this operation are very toxic.*) When all of the foreign metal has been removed from the sides and bottom of the tank, remove the dummy cathodes, sludge, and all of the solution.

2. Give the tank a thorough scrubbing and rinsing with water. The tank is now ready for the preparation of the zinc plating bath.

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mium metal from chromic sulfate solutions containing also ammonium and sodium sulfate, and free sulfuric acid, employing a diaphragm-type cell defining an anolyte and a catholyte, the improvement which comprises incorporating in the catholyte from 0.02 to 10.0 grams of free iodine and from 0.002 to 5.0 grams of mannitol per liter of electrolyte.

CLAIM 3. The process of claim 2 wherein a compartment-type cell is employed having a diaphragm defining an anolyte compartment wherein the iodine is oxidized to iodate, and the said iodate-containing anolyte is withdrawn, treated with a reducing agent, the then-freed iodine is removed and returned to the catholyte.

3 claims.

References cited: U. S. Patents 694,658; 931,944; 1,713,514.

No. 2,579,636, December 25, 1951—Electrodeposition of Nickel—Louis Weisberg.

EXAMPLE I	*Grams per liter*
Nickel sulfate	360
Nickel chloride	30
Formic acid	15
Boric acid	40
Cobalt sulfate	3
Formaldehyde	0.0–0.5
Temperature	70–75 degrees Centigrade
*p*H electrometric	2.3
Current density	40 amperes per sq. ft.
Agitation	vigorous

CLAIM 1. The method of electrodepositing nickel to produce smooth, ductile, easy-buffing deposits which comprises electrolyzing a body of solution containing as essential constituents nickel sulfate 120 to 400 grams per liter, nickel chloride 15 to 60 grams per liter, formic acid 5 to 30 grams per liter, and boric acid 30 to 40 grams per liter, the solution being free of ammonia or ammonium salts in amount which will deleteriously effect smoothing action of the deposited nickel, and free from impurities in amounts of more than 5 milligrams per liter of aluminum, more than 1 milligram per liter of chromium, more than 20 grams per liter of copper and more than 1 gram per liter of ferrous iron, purifying said body of solution with respect to said impurities, the frequency of said purification and the extent thereof being such as to maintain the purity of the solution, during electrolysis, within said limits, maintaining the *p*H of the solution during electrolysis between 2 and 4, and discontinuing the electrolysis before the electrodeposited nickel has exceeded a thickness of substantially greater than 0.003 inch, whereby deposits are obtained which are ductile, easily buffed, and have a surface substantially smoother than the surface of the cathode on which they are deposited.

11 claims, 6 examples.

References cited: U. S. Patents 2,026,718; 2,191,813; 2,196,588; 2,449,422; 2,470,775; 2,533,532. Trans. Electrochem. Soc. 77, 223–231 (1940).

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is one of a complete range of Beckman pH Meters available for every type of application*. The H-2 is particularly recommended for applications where high accuracy and simple operation—combined with the convenience and low cost of 115-v. AC operation—are desired.

It provides instant and direct pH readings, and a simple, built-in dial permits quick, convenient temperature compensation over the entire range of 0° to 100° C (32° to 212° F). High reading accuracy is assured by wide-spread dual range scale that reads from 0 to 8 pH or from 6 to 14 pH at the turn of a switch. Same switch also provides instant millivolt readings from 0 to ±800 mv and from ±600 to ±1400 mv for titrations and oxidation-reduction measurements.

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Particularly important is the wide range of factory-sealed, maintenance-free Beckman Glass Electrodes available for use with this instrument . . . electrodes that are virtually unbreakable . . . that cover extreme temperature ranges from below freezing to above boiling . . . that have an unprecedented pH range with negligible errors . . . that are abrasion-resistant and chemically durable to a degree never before thought possible in glass electrodes.

*In addition to the H-2 Meter, other Beckman pH equipment includes completely automatic pH indication and control instruments for large-scale process applications . . . battery-operated models for complete portability in plant and field use . . . and a laboratory type instrument that features maximum versatility and accuracy for research and laboratory applications.

In plant after plant Beckman pH Control has proved to be the key to higher plating speeds, smoother deposits, fewer rejects in virtually all types of electroplating operations—whether cadmium, copper, zinc, brass, or other types of plating.

For Beckman is the pH equipment that is equally efficient in all metal plating operations—acid or alkaline—regardless of turbidity, organic substance, or oxidizing and reducing agents!

Not only does Beckman provide a complete range of pH equipment for every application from portable plant use to completely automatic control for large-scale processes, but the Beckman line of glass electrodes is the most rugged, the most versatile, the most complete in the industry.

Particularly important to metal plating operations is the fact that Beckman High pH Glass Electrodes can be used in highly alkaline solutions with negligible sodium errors, thus simplifying the control of many types of alkaline plating operations such as cadmium, copper, zinc, brass (both for rubber adhesion and straight brass plating) and other similar metal-plating operations.

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A.E.S. News

A. E. S. Headquarters to Newark

The Society's headquarters will be moved on April 1 to the American Building, 445 Broad Street, Newark 2, N. J., a modern office building in the downtown section.

Space will be available for board and committee meetings.

Delegates' Meeting in Philadelphia a Success

Some forty Delegates met for a special meeting in Benjamin Franklin Hotel, Philadelphia, on February 9. Inasmuch as there was no quorum, no formal decisions were made, but those who attended had an unusual opportunity to become acquainted with the Society's problems and aims and to offer suggestions.

President C. F. Nixon opened the meeting with a discussion of the role that the Delegates can play in the Society. He was followed by First Vice-President F. J. MacStoker, who presented an encouraging report about the Society's finances, and by Second Vice-President Dr. G. P. Swift, who discussed ways and means for increasing the Society's membership. Executive Secretary Dr. Foulke then spoke about Headquarters activities.

Clyde Kelly, Chicago Convention and Exposition Chairman, and Lewis Glassner, Exposition Manager, reported on the excellence of the available facilities, that the plans now made promise a successful meeting, and that Exposition booth space is rapidly being reserved.

The activities of the National Association of Metal Finishers, Inc., were described by its Executive Secretary, R. M. Shock. He asked for A. E. S. support of the Association's attempt to catalogue all plating facilities, in job shops as well as in manufacturing plants, for the use of the U. S. Government in the defense effort.

Third Vice-President Dr. R. A. Schaefer and Research Committee Chairman Dr. Donald Price explained the policies of the Research Committee, and Dr. E. J. Serfass, Project Director for A. E. S. Research Project No. 2 and a Delegate from the Allentown-Reading Branch, described how a project was begun and carried out.

Editorial and advertising problems arising in the operation of PLATING were dealt with by the Editor, K. G. Soderberg, and the Advertising Manager, W. C. Dietrich, respectively, after which Chicago Branch Delegate Paul Glab and Past President E. T. Candee offered comments for the continued improvement of the magazine.

A. P. Munning, President of the Metal Finishing Suppliers Association, Inc. (formerly the International Fellowship Club), reviewed the close relations between his organization and the A. E. S. and pled for economy at entertainment functions of conventions and Branch affairs to lessen the pressure on suppliers for financial support.

The complete proceedings of the meeting will be distributed to all Delegates and Branch Secretaries.

The Delegates that were present expressed the desire that similar meetings be held in the future and that they be located in different regions of the country so that Delegates from all Branches will have their opportunity to attend at a minimum cost.

New Sustaining Members

The number of companies willing to support the A. E. S. Research Program through sustaining membership continues to grow. We welcome the following, which joined in January:

The Christie Plating Company, Croton, Conn.

Bell & Howell Company, Chicago, Ill.

Grand Rapids Plating Company, Grand Rapids, Mich.

Waterbury Companies, Waterbury, Conn.

New Members of the Editoria Board

The following well-known members of the Society have accepted appointment to the Editorial Board:

E. R. Bowerman, Sylvania Electric Products, Inc., Flushing, N. Y.

William Geissman, National Lock Company, Rockford, Ill.

C. W. Ostrander, Allied Research Products, Inc., Baltimore, Md.

With their greatly differing experience and interests, they will bring new views and new ideas to the Board.

Film for Branch Meetings

Harvie J. Johnson of Belke Manufacturing Company, 947 N. Cicero Avenue, Chicago 5, Ill., offers two 1500-ft rolls of 16-mm sound film depicting the entire World War II, from the bombing of the Kearney to the surrender of the Japanese, free of charge for use at Branch meetings. These are actual front-line films, and provide a 2-hour show.

Interested program chairmen may obtain these films by writing to Mr. Johnson, giving date for showing.

✠ Horace Smith Passes On ✠

As we go to press, we are informed that Past President Horace H. Smith passed away on February 21. An Elk funeral service, attended by a large number of A. E. S. members, was held on Sunday, February 24, and was followed by a religious service on the 25th.

Smith served as President for two terms, 1928–1929 and 1929–1930.

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Branch News

COMING EVENTS

BOSTON BRANCH

SIXTEENTH ANNUAL TECHNICAL SESSION AND BANQUET

Saturday, April 19, 1952

Hotel Statler, Boston, Mass.

Educational Session at 2:00 P. M.

"Modern Industrial Hard Chrome Plating", by ARTHUR W. LUCAZZO, Nutmeg Chrome Corporation, West Hartford, Conn.

"Present Day Decorative Plating", by CLEVELAND F. NIXON, General Motors Corporation, Detroit, Mich., President, American Electroplaters' Society

"Recent Developments in the Disposal of Plating Wastes", by DR. LOUIS WEISBERG, Consulting Engineer, New York City

Banquet at 7:00 P. M.

BALTIMORE-WASHINGTON

The January meeting was a January 8th plant tour of the Calvert Distilling Company, of Relay, Md.

Before the tour, a short business meeting was held to discuss several rather important issues that could not wait for the February meeting.

It was the opinion of all who attended that the Branch has never been treated to a better organized and more courteously conducted tour. Everyone was also impressed with the cleanliness of the entire plant. Needless to say most members of the party were put through the taste test, and about 80 per cent were "Men of Distinction".

V. J. HUGHES, Jr., *Secretary*

CINCINNATI BRANCH

Another fine turnout was on hand for the meeting on January 23. PRESIDENT ROBERT D. MILLER opened the proceedings with a discussion of the Delegates' meeting to be held at Philadelphia on February 9. The Secretary was instructed to send a letter to the Executive Board, Executive Secretary and all Branch Secretaries informing them that no Cincinnati member would attend because of the high cost involved and the possibility of conducting regional meetings at lower cost. Because considerable unjust criticism has been levelled at the plating industry for its inability to provide finishes of a pre-Korean war quality on consumer products, it would be suggested that a promotional campaign be conducted to explain the hardships under which the plating industry is operating.

Two resignations were granted inasmuch as both members had left the city, and two candidates for membership were elected unanimously.

In place of the announced speaker, Mr. H. E. Head of Detroit, who was unable to attend on account of illness and press of business, MR. JOHN E. KINNEY, Sanitary Engineer of the Ohio River Valley Sanitation Commission, gave a talk on "Industrial Water Treatment and Pollution Abatement". He first explained the functions of the Ohio River Valley Sanitation Commission, and then pointed out that the more industry, the more pollution. However, with proper treatment, polluted waters can be used again and again, and that much is being done to improve the conditions by "impelling" rather than "compelling". Many valuable materials could be saved from waste, particularly by small shops, the waste of which can be just as harmful as that from the large production plants. The amount of chemicals lost can be reduced by proper treatment, even by small companies. Concluding with the pertinent thought that the prime reason for prevention of pollution is water conservation, Mr. Kinney cautioned his audience to measure their waste loads, reduce them, then treat.

The Udylite Company, Detroit, acted as hosts for the customary Social Hour that followed.

CHARLES WISE, *Secretary*

DAYTON BRANCH

At the regular meeting on January 4, at the Biltmore Hotel, VICE-PRESIDENT CLINEHENS introduced and elaborated on a recommendation by the Board of Managers to accept an invitation from the Dayton Technical Societies Council to participate in a series of television shows. It was noted that such participation would give the Branch an opportunity to present to the public, among other things, highlights of the function of electroplaters in the production of many household articles.

"Alloys for Handling Plating Solutions", a talk presented by MR. LUCE of the Duriron Company, proved to be very enlightening. Cognizance was taken of the importance and method of selecting proper alloys to handle corrosive solutions.

Informal discussions continued while refreshments were served following the meeting.

PAUL E. GESKE, *Secretary*

HARTFORD BRANCH

The meeting on January 21 at the Bond Hotel was attended by 58 members and guests. Preceding the meeting, a colored film entitled "Building a Rubber Tire" was shown. MR. GEORGE B. HOGABOOM then gave a report on "New Developments in the Finishing Industry".

The speaker for the evening was MR. JOHN V. DAVIS, Chief Engineer of the Udylite Corporation, whose subject was "Engineering Aspects of Plating". (See review of Mr. Davis' talk before the St. Joseph Valley Branch.)

The Technical Chairman for the evening was AL DANKEVICH, and refreshments were served through the courtesy of MacDermid, Inc.

STANLEY PLATOZ, *Secretary*

INDIANAPOLIS BRANCH

The 23 persons who attended the meeting on January 10 heard a very interesting talk on "How's Your G. P." by MR. L. L. HOLMES, Director of Certified Personnel Service, Indianapolis. G. P., short for growth potential, is a measure of one's chance of success. Each pertinent human characteristic needs investigation and evaluation, and he who improves his weakest characteristics increases his chances of success. The following questions need be answered: (1) Do you create confidence, in customers, superiors, coworkers and those who work under your direction? (2) Do you have energy to release to the job, and do you focus it easily? (3) Do you have, or are you acquiring, "experience capital"? (4) What is your learning capacity, and do you work at improving it? (5) Are your action patterns best adapted to a specific job? (6) Do your likes and dislikes help you to be enthusiastic about the job you are asked to do? (7) What is your speed and accuracy? (8) How are your behavior tendencies; are you responsible and reliable, or are you a short changer; are you egocentric or egotistical; do you plan and follow through? (9) What is your reputation?

The Branch voted not to take part in the Chicago Branch Exhibit. TREASURER R. C. BRUCK explained that with the change in fiscal year, the 1952 dues will be only $6.00.

EDWARD BRUCK, *Secretary*

LANCASTER BRANCH

The Branch held its January meeting on the 11th at the Old Mill Inn, Lincoln Highway West, Lancaster, Pa. Thirty-three members and guests attended.

Reporting for the History Committee, CHRIST BRUBAKER and HARRY HOVIS presented an outline of the history of the Branch, which will be passed upon by the executive board. LIBRARIAN MARIAN MEYERS then introduced MR. JACK WINTERS, of the R. O. Hull & Company, whose subject was "New Ideas in Plating and Control". His presentation followed that of the paper on "Operating Control for Optimum Plating Characteristics", by R. O. Hull and the Speaker, published in the 1951 Proceedings of the Society.

After the meeting had adjourned, a Dutch Lunch was served through the courtesy of MR. ROLAND HOENSTINE.

HARRY A. SAYLOR,
Secretary-Treasurer

LOS ANGELES BRANCH

MR. B. F. LEWIS of Northwest Chemical Company, Detroit, Mich., addressed the 90 members and guests who attended the meeting on January 8. One of the

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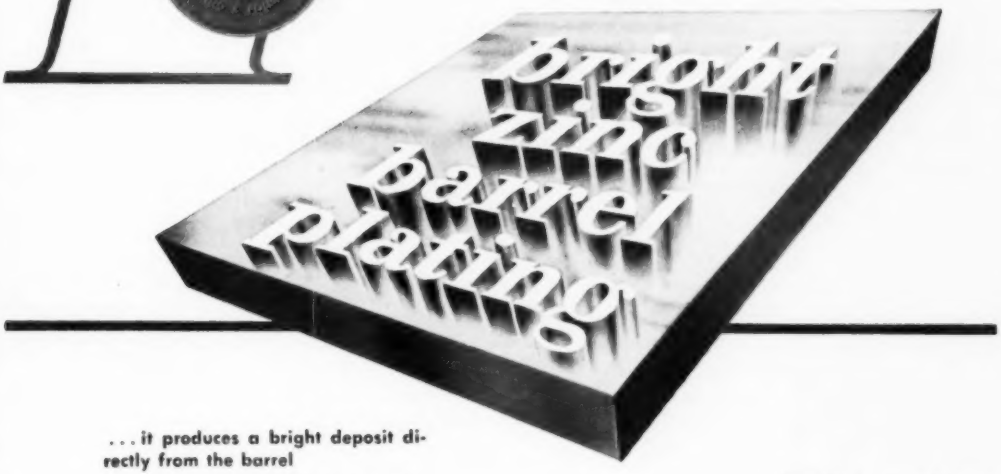

. . . it produces a bright deposit directly from the barrel

. . . it develops brilliant deposits over a wide range of current densities

. . . it eliminates need for subsequent bright dipping

. . . it has unusual tolerance for impurities

. . . it combines economy with simplicity

. . . it readily accepts conversion coatings and can be soldered with relative ease

BBZ-200, is an exclusive H-VW-M development. Its use in plating solutions permits zinc-plated parts to come flashing bright from the plating barrel. Finished products and parts plated by the BBZ-200 process not only *look* brighter, they *stay* brighter longer, have higher resistance to oxidation and tarnish. Low concentration of BBZ-200 Brightener in the bath plus low consumption add up to real economy in this outstanding process.

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founders of his company, in 1932, he had a very excellent grasp of his subject: "Modern Metal Cleaning Methods and Materials" both from a practical and a technical standpoint.

To determine optimum cleaning methods and materials, his company settled on 10 different standard methods for removing 100 different, but representative, buffing compounds from diecastings. Different compounds required definitely different cleaning methods. One of the reasons for cleaning is the chemadsorption, whereby oils and grease from drawing, tapping, polishing or buffing adhere strongly to the surface of metals. Wetting or surface-active agents must be chosen for the job to be done, and may be used in water solution, in alkaline cleaning solutions, or in a petroleum-base or chlorinated solvent. Over 900 synthetic detergents are made today.

The three basic steps in cleaning are removal of greases, removal of solids, and surface activation. Manual scouring will accomplish each step but generally only in hit-or-miss fashion, and can be replaced or improved by suitable materials and processes. Cleaning should be as prompt as possible after the drawing or buffing operation, so as not to give the oils too long a time to react with the surface of the metal.

Mr. Lewis used slides to illustrate various points in his talk. He also outlined standard cleaning procedures for various materials.

G. Stuart Krentel, *Secretary*

Montreal Branch

The guest speaker at the meeting on November 6 was Mr. Guffie, United Chromium, Ltd., who gave a most interesting and enlightening talk on the self-regulating chromium plating baths. With the help of slides, the speaker compared this bath with the conventional type, pointing out the advantages and shortcomings of each. The S. R. H. S. baths have wider bright-plating range, higher plating speed, self-regulation, and higher cathode current efficiencies, and it permits greater output per unit of equipment, bright plating on stainless steel and on zinc diecastings. With them it is possible to do plant-scale barrel plating. However, the bath must be kept under control, free from drag-in and the whole preceding plating cycle be good. The interest in the talk was so great that questions were still going strong at 10:15 P. M.

A membership report was made by the secretary, and one new member was elected.

L. A. Robillard, *Secretary*

Montreal Branch

Twenty-eight members and guests heard Mr. Clifford Struyk, General Dye & Chemical Corporation, present an illustrated and most instructive talk on fluoborate plating solutions on December 4.

Stereotypes can be pickled in fluoboric acid at room temperature in 10 sec. and nickel-plated directly. Fluoboric acid pickling leaves no film, will remove silicates from diecastings, and pickled parts are readily soldered.

The lead fluoborate bath is used for plating wire, cable, stainless steel, etc., and for bearings and bearing liners. The best alloy for this application is the lead-tin-copper, which is resistant to both lubricating oil and to wear. The copper fluoborate bath is outstanding for its plating speed. It is superior to the copper sulfate because it is almost free from anode polarization at high current densities. The nickel fluoborate bath can be a high-metal bath on account of the solubility of its salts. Its resistivity is about half that of Watts bath, and the cathode current distribution is more uniform. The *p*H is more stable, and deposits have lower stress than comparative Watts and chloride baths even in the presence of impurities. The speaker concluded that fluoborate baths are easy to operate, very stable, and possess high plating speed.

One hundred and sixty-eight tickets had been sold for the Banquet. The banquet chairman thanked everyone, especially President Glover, for their great help. The Board of Managers took under study the question of re-admission of expelled members.

L. A. Robillard, *Secretary*

Newark Branch

Because of a severe snowstorm, the regular meeting got underway at 9:30 P. M. There was no business session and other formalities were dispensed with.

Librarian Robert Horrocks introduced the two speakers of the evening, Mr. Harold Faint, of the Industrial Filter & Pump Manufacturing Company, and Mr. F. L. LaQue, of The International Nickel Company. In their very excellent talks, the former stressed that a good filtration system involves the consideration of the volume of solution to be filtered, the flow rate desired, composition of the liquid being filtered, the type of filtration cycle, and the filter aids employed. The latter speaker pointed out that there are in the main, four principles involved in galvanic corrosion of metals, namely, the initial potential difference between each metal in the couple, the polarization characteristics of the metals involved, the resistance offered to the galvanic current by the electrolyte between the metals, and the resistance in the pores of the coated metal.

Samuel S. Frey, *Recording Secretary*

New Haven Branch

A. E. S. Executive Secretary Dr. D. Gardner Foulke discussed the mutual problems of Branches and A. E. S. Headquarters Office at the meeting on November 13.

The featured speaker was William Sheane, Sales Manager of the Zapon Division of the Atlas Powder Company. Discussing "Government Specifications in Organic Finishing", he explained many of the terms used in Government specifications and complexities incidental to specification finishing, including the steps necessary to meet a specification. It was an extremely interesting presentation of a very difficult subject.

L. Durney, *Librarian*

New Haven Branch

On December 11, Mr. S. J. Calvin, of Parker Rust-Proof Company, spoke about "Phosphate Finishes". He discussed, progressively, the history of his subject and the various types of phosphate coatings with their respective fields of application. He also pointed to a number of things to watch for from a practical point of view. The talk was well illustrated with slides that aided the listeners to understand the problems.

L. Durney, *Librarian*

New Haven Branch

The meeting on January 12 took the form of a very enjoyable dinner at the Moose Club, Wallingford, Conn. The International Silver Company treated the ladies to a movie, "The Romance of Silver", and the Mad Hatters from Yale provided the entertainment. About 45 people attended.

L. Durney, *Librarian*

New York Branch

The meeting on December 14 saw three applications for membership received and two men elected to membership.

Following the business meeting, Mr. Myron B. Diggin, of the Hanson-Van Winkle-Munning Company, gave a very interesting and informative talk entitled "Plating Under Today's Conditions". A very lively question-and-answer period followed, after which everyone enjoyed the refreshments.

Peter L. Veit, *Recording Secretary*

New York Branch

Six membership applications were received and 5 new members were elected at the meeting on January 11.

Secretary-Treasurer George Schore announced that a new course in electroplating was to be started at Brooklyn Technical High School. First Vice-President Angelo Amntore was made Chairman of the committee that is to organize the Branch Exhibit at the Industrial Finishing Exposition. Second Vice-President Albert Fusco reported the preparations for the Banquet to be in full swing. William J. Schneider, on behalf of the Board of Managers, recommended William Foss to honorary membership.

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Branch News

A. E. S. First Vice-President Franklan MacStoker and Second Vice-President Dr. George Swift explained the purpose of the Delegates' meeting in Philadelphia, and stressed that while no decisions could be made, there would be full reports on the Society's activities and an opportunity to iron out gripes by the Branches. It was then decided to send an uninstructed delegation.

Mr. Sidney Lewis, of U. S. Stoneware Company, gave a very interesting and practical talk on tanks and tank linings.

Peter L. Veit, *Recording Secretary*

PHILADELPHIA BRANCH

Due to the tie-up of transportation by a very heavy snowstorm, no meeting was held on December 14. Only one member, Second Vice-President William Trusdell, made it, his dog sled being in good condition. Instead a meeting of officers and committees was held at Mosebach's Restaurant on January 15 to transact necessary Branch business.

The regular Branch meeting on January 25, in the Harrison Laboratory of the University of Pennsylvania, was attended by 45 members and guests. Dr. Samuel Heiman, General Chairman of the 1953 Convention Committee, read the names of the chairmen of the committees and announced a meeting at which the scope of activities of each committee would be outlined.

The speaker, Dr. Walter R. Meyer, President of Enthone, Inc., was introduced by Librarian Boerckel. Speaking on "Chemical Conversion Coatings", he discussed the formation and practical applications of the following types of coatings: (1) Phosphate, including iron, zinc and manganese types; (2) Chromate; (3) oxide on copper, zinc, aluminum and steel; (4) sulfide; (5) Fused dichromate on stainless steel. The iron phosphate coating has about double the bond strength of that formed by zinc dihydrogen phosphate. A coordinating compound, such as a sulfate, nitrate, formate, chloride or acetate, is necessary with chromic acid in order for a coating to form. A high ratio of chromic acid to coordinating compound produces a bright dip; an increase in the amount of the coordinating compound gives a more permanent and heavier coating. He explained the similarity of mechanism in chromium plating and chromium conversion coating. Considerable discussion followed Dr. Meyer's talk.

President Pope summarized the business transacted at the January 15 business meeting. The Secretary reported on tentative plans for making the June meeting an outing. A motion was passed that the Branch pay expenses of the Delegates incident to the February 9 meeting. Three new active members were admitted; four applications for membership were received.

I. Wm. Marcovitch, *Secretary*

PITTSBURGH BRANCH

Icy roads and hazardous driving conditions prevented a great number of the members from attending the meeting on January 10. However, approximately 20 members were able to reach the Sheraton. The business meeting was dispensed with until more members could discuss several important matters.

Mr. Clyde Cupps, of Standard Steel Spring Company, delivered a fine paper titled "Practical Waste Disposal". The lengthy discussion period which followed was indicative of the quality of the presentation. Everyone present felt that this was one of the most interesting and timely subjects that has been discussed during the present year.

R. H. Schindler, *Secretary*

PROVIDENT-ATTLEBORO BRANCH

The annual Christmas Party was held on December 10 at Johnson's Hummocks on Allens Avenue under the capable direction of Gerry Noonan. It was a success, both as to attendance and to the quality of the dinner, in spite of the bitter cold of that night. There was much favorable

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comment on the new policy of not having any speeches at such gatherings. Mr. William Chace was the holder of the winning ticket for the door prize, a large Sessions clock.

The January meeting was held on the 21st at the Providence Engineering Society Building on Angell Street. Mr. Herbert Goldman of Enthone discussed "Finishes for Aluminum". The first portion was devoted to electroplating on aluminum, and the zincate treatment was the preferred pretreatment. The only electroplates which show any anodic action in conjunction with aluminum are zinc and cadmium, and these plates have this property only in a few corrosive systems. Nickel plate directly on the zincate coating is best for use at high temperatures. The latter portion of Mr. Goldman's talk dealt with immersion oxidation of aluminum and subsequent coloring with dyes. The coating is extremely thin and is entirely dependent on the lacquer coating for its wear resistance. Another topic was alkaline electrolytic derusting of steel.

Attendance was the largest of the season, some sixty-odd members and guests.

A nominating committee, composed of Ray Mitchell, Jack Henry and Phil Clarner, was appointed to bring in a slate of officers for the election in March.

Edward A. Parker,
Secretary

ROCKFORD BRANCH

Twenty-five were on hand for the dinner and 34 for the lecture at the December meeting.

A motion by Elsworth Budden that we appropriate one dollar per member to the Society's Research Fund carried with unanimous vote. Leonard Weeg gave a brief talk on where the research money goes and what is being done. Elsworth Budden announced the date of the Annual Banquet as April 19.

Roger Johnson introduced Mr. Berg of Berg Associates. His subject, "The Human Factor in Business and Industry", proved extremely interesting, and a large portion of the group asked questions and expressed views during the question period. Mr. Berg pointed out how the human element is so often left out of consideration although it must be dealt with each day of the year.

Kenneth A. Kieselberg,
Secretary-Treasurer

ST. JOSEPH VALLEY BRANCH

Thirty-six members and guests were present at the dinner and thirty-nine attended the technical session on January 9.

Three new members were elected to active membership, and three applications for membership were received. Richard Lockerbie reported on the membership drive, and William McDowell reported on the Sustaining Membership Drive and inquired about Branch exhibits for the Chicago Convention.

The Branch voted to send $100.00 for a Branch Sustaining Membership for the A. E. S. Research Fund. President Dr. Ernest Wilhelm appointed Mr. Wm. McDowell as Chairman for the special Ladies' Night on April 2.

The secretary was instructed to write to the Los Angeles Branch that our delegates would tentatively support the candidacy of Richard C. Wooley for Third Vice-President.

Librarian John Bayman introduced the guest speaker, Mr. Arthur M. Linn of United Chromium, Inc. In his well-organized paper on "Anozinc and Dip Coatings for Zinc" Mr. Linn outlined the various chromate treatments, and stated that the dip process had the advantages of producing a uniform coating, of not requiring electrical equipment, of permitting bulk handling, and of providing a coating that has good corrosion resistance and serves as a good paint base. The electrolytic process, on the other hand, requires no special equipment, provides a coating of excellent corrosion resistance that serves as an excellent paint base, is not fragile when wet, can be effectively dried in hot water (heavy dip coatings cannot) and has good abrasion resistance.

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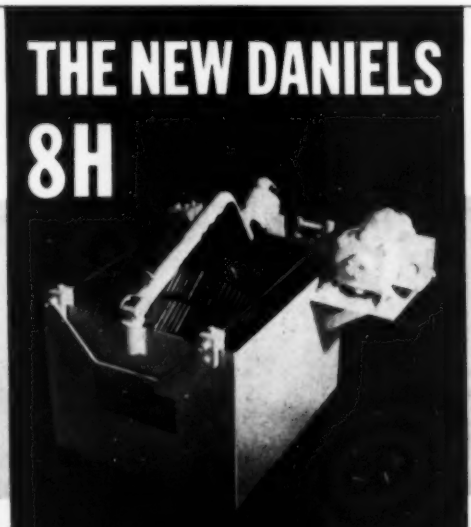

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Branch News

	Color
Zinc Oxide, ZnO	White
Zinc Chromate, $2nCrO_4$	Yellow
Chromic Chromate, $Cr_2(CrO_4)_3$	Brown
Chromic Hydroxide, $Cr(OH)_3$	Bluish green
Chromyl chromate, CrO_2CrO_4	Black

The final color of the film is often the result of a secondary complicated reaction. In general, the darker finishes require the longer processing time and the higher current, temperature and *p*H.

Dip processes form gelatinous films of high water content that require careful handling. The electrolytic process reduces the water content, and the solid films produced may be handled as the parts are removed from the solution.

After the presentation of the paper, Mr. Linn answered related questions from the floor.

EUGENE ROTH, *Secretary-Treasurer*

SOUTHEASTERN BRANCH

The 8 members present at the meeting on December 14 decided to designate the New York Branch as proxy at the special Delegates' meeting.

One application for membership was accepted.

The proposed By-laws were discussed and accepted, and will be forwarded to the Supreme Society for review.

The speaker, DR. R. J. RAUDEBAUGH, then discussed some of the newer plating processes; the deposition of nickel-phosphorus alloys, the use of electropolishing to produce very fine wires, the use of a micro-hardness tester, and periodic reverse current plating.

E. P. COFIELD, *Acting Secretary*

SOUTHEASTERN BRANCH

The January meeting was held in the Georgian Hotel the 11th.

A motion was passed that the May meeting of the Branch be held in Jacksonville, Fla., with all arrangements, including the program, handled by members residing in the vicinity of Jacksonville. It was decided to hold a Ladies' Night on August 8. PRESIDENT WEYMOUTH appointed WILLIAM KELLY, HERSCHEL STOGNER, and CHARLES T. LEWIS to handle the arrangements for this affair.

The speaker of the evening was MR. R. B. BELSER, of Georgia Tech Engineering Experiment Station, who presented one of the most interesting talks that the members have heard in several years. He discussed the formation of thin metallic films in vacuum and described many of the properties of such films.

E. P. COFIELD, *Acting Secretary*

SYDNEY BRANCH

The December meeting was held on the 17th in the Great Southern Hotel.

After an excellent meal, the members were entertained by several artists, and between acts talked plating from olden days to present times.

This was our first social of this type, and was voted a welcome change from the customary "Smoke" concert.

Time passed too quickly, and it was regretted when the time limit was reached at 10:30 P. M.

W. W. PATERSON, *Secretary-Treasurer*

SYRACUSE BRANCH

The first meeting of the new year was held on January 21 at the Moose Hall. Of the 45 members and guests who attended, many arrived early to enjoy a dutch-treat dinner of ham.

A March of Time Civil-defense picture was shown through the courtesy of General Electric Company, Electronics Park, Syracuse, N. Y. One of our members, GEORGE W. CAVANAUGH, played the part of the Colonel, with the Park Players of G. E. providing most of the cast.

The speaker of the evening was MR. HAROLD W. FAINT, Sales Manager of Industrial Filter & Pump Manufacturing Company, Chicago, Ill. His subject was "Industrial Filtration", which was very interesting and led to a lively question period.

Refreshments were provided by Pennsylvania Salt Manufacturing Company, Philadelphia, Pa. Its representative, MR. J. J. KEERS, JR., was the host.

LINDLEY S. WOOD, *Secretary*

TORONTO BRANCH

The guest speaker on December 14 was DR. HARRY M. WALKER, of the Richardson-Allen Corporation, who was introduced by KERGAN WELLS. Dr. Walker's subject was "The Installation and Maintenance of Rectifiers". This title, however, proved to be an understatement, as he told us about everything the user may wish to know about rectifiers, including types of rectification, types of cells, and types of controls and their applications. It was very interesting and everyone went away from the meeting more enlightened.

Following the discussion, we were fortunate to see an informative film, "Electroforming Iron Searchlight Reflectors", which showed much of the automatic devices that one hears about but never sees. Automatic *p*H control and adjustment of solution level, and continuous filtration were some of these devices. ARCHIE SMITH had obtained the film from the U. S. Department of the Army, The Engineering Research and Development Laboratory, Fort Belvoir, Va. It is a shining example of the good relations that exist between these two great countries when a private Canadian citizen can borrow a film from the U. S. Government just on the strength of his own name.

The Annual Dance at the Club Kingsway proved to be the best one yet. Congratulations go once again to BENNY CAMERON for a fine job.

A. L. COXHEAD, *Correspondent*

WATERBURY BRANCH

It is now time to make plans to attend the New England Regional Meeting, held again in the Hotel Taft, New Haven, Conn. The date is Saturday, April 26. Committees from the cooperating Branches are already working hard to make the meeting the most successful ever. Waterbury's representatives on the Regional Committee are E. W. COUCH, FRANK EDDY and E. V. COLLINS.

"The Analysis of Electroplating and Related Solutions" by K. E. LANGFORD was reviewed by DOMENIC MENCIO at the regular meeting January 11. Recently published in England, this text contains details of over 300 methods for analyzing constituents and impurities in plating solutions.

The scheduled speaker, A. E. S. PRESIDENT C. F. NIXON, was unfortunately unable to be present due to illness in his family, but Perry Sloane, who had planned to give a paper in March, kindly consented to present it at this meeting. He is Technical Director of Donham Craft, Inc., and has had over ten years' experience in precious-metal plating. His subject, "Bulk Plating of Plastics", is still quite new in electroplating and one which at this time is of special interest because of the metal shortages.

Small plastic parts are usually made of thermoplastic, sometimes of thermosetting resins. Both have a hard shiny surface which must be slightly roughened for a good bond to the initial silver coating. Pumice or sand is usually used as the abrasive medium during the rolling in oblique barrels. Next the standard reduction method of depositing silver is used, with careful cleaning and the usual stannouschloride treatment. All are accomplished during rolling in barrels, and are followed by plating of a heavy deposit of copper from an acid copper solution in standard horizontal plating barrels. From here on the procedure follows closely the accepted practice for finishing and plating small metal parts.

Burnishing is accomplished with soap and steel balls, and the final finish is usually gold or silver. Careful control of solutions and recovery of precious metals are necessary to make the process economical and successful. A variety of small parts distributed by the speaker illustrated the versatility and possibilities of this interesting and unique process.

SPENCER L. HENN, *Secretary*

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Elections

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BUFFALO: E. B. Payson, E. F. Sloan

CINCINNATI: F. L. Bonem, J. T. Ryan

CLEVELAND: J. T. Irwin, F. W. Walker

COLUMBUS: A. J. Cortese, F. Gentile, Jr., W. V. Hobbs, H. L. Moore, S. B. Moore, F. W. Pinkerton, A. A. White

DETROIT: J. R. Ewing, C. D. Gerard, Jr.

GRAND RAPIDS: T. V. Wallace

HARTFORD: R. J. Grenier, K. W. Joseph, E. A. Michno, G. E. S. Teshow

JACKSON-LANSING: H. T. Chadwick, W. J. Levy

LOS ANGELES: B. W. Barber, N. K. McEwan, H. Rubin, P. C. Silverstone, O. Stein

NEW YORK: P. Goldman, B. Operowsky, F. E. Rondepierre, J. J. Schneidt, N. J. Sendalena, C. Sivelle

PHILADELPHIA: K. Ehrlich, J. C. Sharbaugh, R. S. Weisman

PITTSBURGH: G. J. Grindel, W. Oberyshko, W. A. Thompson, D. W. Tuckwiller, K. H. Wagner, Jr.

ST. JOSEPH VALLEY: J. P. Borden, J. R. Curtis, M. Oswald

SAGINAW VALLEY: R. P. Blake, H. J. Breithart, S. Harger, D. Ritzema, J. A. Spaulding, J. L. Whitley

SYRACUSE: J. H. Bowers, H. L. Amedro, S. W. Aker, J. B. Findling, R. W. Hergenrom, J. F. Kabat, G. C. MacEwan, A. Marzocchi

TORONTO A. J. Adams, T. L. Batke, H. A. Bryson, R. L. Edwards, W. L. Grover, F. B. Jopson, J. M. LeRoy, S. Otaguro, H. H. Redlich

TWIN CITY: C. J. Ahlgren, R. F. Byron, F. H. Kelpatrick, A. G. Levine, H. Lund, E. McMonagle, C. Platt

Reinstatements

CINCINNATI: A. Schwering

COLUMBUS: T. F. Lavery, H. D. McManus

GRAND RAPIDS: J. Wickering

PITTSBURGH: R. T. Graf

TORONTO: H. Dyer, E. Moss

TWIN CITY: F. E. Revell

MEMBERS-AT-LARGE: L. C. Hamilton, B. Piontelli

Transfers

T. R. Williams to Cleveland; F. H. Bruening to Cleveland; J. E. Fritts from Columbus; B. B. Logan from San Francisco to Los Angeles; W. D. Wilson from Newark; J. Banta from Toledo; A. B. Turrall from Toronto

Resignations

CINCINNATI: G. J. Kahan

GRAND RAPIDS: W. K. Aiken

HARTFORD: R. Joerres

TWIN CITY: C. A. Kapelian, R. H. Peterson, E. W. Schwanz

Suspensions

BALTIMORE-WASHINGTON: R. Borichersky

Membership Competition

BRANCH	Membership Apr. 1, 1951*	New Members	Net Change in Membership	Per Cent Net Change
First Group				
Melbourne	126	36	+30	+23.8
Chicago	409	44	+41½	+10.1
New York	279	29	+23	+8.2
Hartford	137	13	+9	+6.6
Cleveland	205	21	+5½	+2.7
Waterbury	126	4	+2	+1.6
Milwaukee	143	11	+2	+1.4
Bridgeport	152	9	+1½	+1.0
Newark	239	13		
Pittsburgh	132	10	−2	−1.5
Detroit	492	30	−7½	−1.5
Los Angeles	211	16	−3½	−1.7
Philadelphia	201	14	−5	−2.5
Boston	151	12	−10	−6.6
Grand Rapids†	164	12	−11½	−7.0
Second Group				
Buffalo	85	16	+15	+17.7
Syracuse	85	20	+14	+16.5
Rockford	67	10	+10½	+15.7
Indianapolis	92	8	+10	+10.9
Toronto	121	9	+8½	+7.0
Baltimore-Washington	87	8	+4	+4.6
Rochester	88	9	+2½	+2.8
Montreal‡	77	14	+2	+2.6
Cincinnati	88	6	+1½	+1.7
St. Joseph Valley	71	7	+½	+0.7
Providence-Attleboro	100	1	+½	+0.5
Dayton	82	2		
St. Louis	105	3	−3	−2.9
Sydney	93	3	−6	−6.5
New Haven	108	3	−19	−17.6
Third Group				
Dallas-Fort Worth	31	14	+13½	+43.5
Houston	25	8	+9	+36.0
Saginaw Valley	57	21	+14½	+25.4
Jackson-Lansing	52	7	+5½	+10.6
Lancaster	60	5	+4	+6.7
Louisville	23	1	+1	+4.4
Twin City	66	8	+1½	+2.3
San Francisco	65	5	−½	−0.8
Allentown-Reading§	42	2	−½	−1.2
Southeastern	48	5	−1	−2.1
Columbus	54	9	−1½	−2.8
Springfield	54	4	−4	−7.2
Toledo	45		−4½	−10.0
Adelaide	65	5	−7	−10.8
Hamilton	25	3	−3	−12.0
Western Ontario	23	5	−5	−21.7
Outside Competition				
At Large	120	15		
In Transfer	16		+13	
Total A. E. S.	5,387	525	147	2.7

Active Membership, February 1, 1952 5,534

*Subject to correction. †, ‡, §Winners in first, second and third group, respectively, of 1950–1951 membership competition.

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COLUMBUS: A. C. Turner, P. C. Zang
GRAND RAPIDS: R. B. Hames, B. Kumko, L. Myers, L. Poyer, J. Sweetland
NEW YORK: T. Charlier, S. Gewertz, R. N. Lee, W. H. Nicholson, J. Swantek
TWIN CITY: F. W. Haungs

Deaths

COLUMBUS: K. J. Miller, Sr.
GRAND RAPIDS: A. Phillips
TORONTO: J. Bert-Gerrans

Convention News

(*Continued from page 274*)

second and third for her attendants. The lady chosen Queen must be over 16 and must be present at the drawing.

Selecting a few from among Chicago's many attractions is always a difficult task, but the places where the ladies will be entertained have been wise choices. Among them is the Narcissus Room at famous Marshall Field & Company, where tea will be served and where the high point will be a style show.

At the International Fellowship Club party in the Grand Ballroom of the Hilton Hotel, where the ladies will join men for an evening of fun and frolics, the Queen of the Convention will be crowned.

Dave Clarin will again preside as host and only man at the Aunt Ella Society Garden Party-Luncheon in the McKinlock Memorial Court of the Chicago Art Institute. This charming garden is a favorite sketching spot for the students of the Institute and will furnish a delightful escape from the bustle of the city. Following the luncheon, the ladies will move indoors for a talk on the furniture, china and other magnificent works of art exhibited at the Institute. The ladies will then be free to visit the galleries and view the exhibits of this famous Museum.

Each year everyone looks forward to the fun of a Plato party. Mrs. Joan Wiarda, hostess, promises a bingo- and prize-filled morning. Sulie Harand, monologist, will be a high point of the luncheon program in the famous Boulevard Room of the Conrad Hilton Hotel. All this, plus a final visit to the International Amphitheatre where the ladies will view the exhibits at the Industrial Finishing Exposition and hear a talk by an authority on costume jewelry or kitchenware or both, will be climaxed by the Annual Banquet and Ball on Thursday night.

In her few hours of free time, Mrs. A. E. S. may want to visit other points of interest in Chicago or attend radio or television performances at Chicago Broadcasting Studios. Tickets for "The Breakfast Club", "Welcome Travelers", and other programs will be available. The North Assembly Room in the Conrad Hilton Hotel will serve the ladies as an information center, meeting room and place of departure for all functions.

With all these fine things in view, many families will plan their vacations around a trip to Chicago in 1952.

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1—6000 AMPERE, 2/6 VOLT, **JANTZ & LEIST.** Separately Excited.
1—6000/3000 AMPERE, 6/12 VOLT, **BOGUE.** Synchronous Motor. Separately Excited.
1—5000/2500 AMPERE, 6/12 VOLT, **EAGER ELECTRIC CO.** Separately Excited.
1—3000/1500 AMPERE, 6/12 VOLT, **HANSON-VAN WINKLE-MUNNING CO.** Synchronous Motor. Exciter-in-Head.
1—2000/1000 AMPERE, 6/12 VOLT, **HANSON-VAN WINKLE-MUNNING CO.** Synchronous Motor. Exciter-in-Head.
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1—4000 AMPERE, 40 VOLT, **CHANDEYSSON.** Synchronous Motor, 440/3/60. Exciter-in-Head. Complete Controls.
2—1000 AMPERE, 30 VOLT, **IDEAL.** Exciter-in-Head.
1—1000 AMPERE, 40 VOLT, **CHANDEYSSON ELECTRIC CO.** Synchronous Motor. Exciter-in-Head.
1—500 AMPERE, 40 VOLT, "**M. G. C.**" Exciter-in-Head.
1—400 AMPERE, 40 VOLT, "**M. G. C.**" Exciter-in-Head.
1—500 AMPERE, 25 VOLT, **CHANDEYSSON** 25 DEGREE. Synchronous Motor. Exciter-in-Head.

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40 Thames Street, New York 6, N. Y.

Secretary..... The Executive Secretary

ADELAIDE, AUSTRALIA meets second Wednesday of each month. Address G.P.O. Box 598E, Adelaide, S. A., Australia.

ALLENTOWN-READING meets third Wednesday of each month in Spurgeon's Hotel, Allentown, Pa. Secretary-Treasurer, Mrs. Pearl T. Treisbach, 610 Allen Street, Allentown, Pa. Research Finance Committee Chairman, William R. Pfeiffer, Jr., 975 Green Street, Allentown, Pa.

BALTIMORE-WASHINGTON meets second Tuesday of each month with meetings in Baltimore at the Engineers' Club and in Washington, D. C., at the National Bureau of Standards. Secretary, Vincen J. Hughes, Jr., Hughes Chemical Supply Company, 1411 Fleet Street, Baltimore 31, Md.

BOSTON meets first Thursday of each month in Hotel Statler. Secretary, Dr. George P. Swift, 53 Galen Street, Watertown 72, Mass. Research Finance Committee Chairman, Eugene P. Carter, c/o United Carr Fastener Corporation, 81 Ames Street, Cambridge, Mass.

BRIDGEPORT meets second Friday of each month in Barnum Hotel. Secretary-Treasurer, Gerald B. Rice, 367 Granfield Avenue, Bridgeport 8, Conn. Research Finance Committee Chairman, Carl Schaefer, c/o Casco Products Corporation, 512 Hancock Avenue, Bridgeport 5, Conn.

BUFFALO meets first Friday of each month in Markeen Hotel. Secretary and Research Finance Committee Chairman, B. P. Fortin, Jr., 209 Forest Drive, Orchard Park, N. Y.

CHICAGO meets second Friday of each month at 8 P. M. at Western Society of Engineers, 84 E. Randolph Street. Secretary-Treasurer, Paul Glab, 882 N. Paulina Street, Chicago, Ill. Research Finance Committee Chairman, William B. Johnson, c/o Industrial Filter & Pump Manufacturing Company, 5914 Ogden Avenue, Chicago 50, Ill.

CINCINNATI meets fourth Wednesday of each month at 8 P. M. in Engineering Society Headquarters, McMillan Street and Woodburn Avenue. Secretary, Charles Wise, c/o The Buckeye Products Company, 7020 Vine Street, Cincinnati 16, Ohio.

CLEVELAND meets first Friday of each month in Hotel Carter at 8 P. M. Secretary-Treasurer, Harry Pochapsky, 24961 Euclid Avenue, Euclid 17, Ohio. Research Finance Committee Chairman, John D. Little, c/o The Harshaw Chemical Company, 1945 E. 97th Street, Cleveland 6, Ohio.

COLUMBUS meets first Friday of each month at 8 P. M. in Battelle Memorial Institute Auditorium. Secretary-Treasurer, John Soderberg, 40 W. Long Street, Columbus, Ohio. Research Finance Committee Chairman, Fred Brune, R. D. 7, Marion, Ohio.

DALLAS-FORT WORTH. Secretary, C. A. White, 715 W. Davis Street, Dallas 11, Texas.

DAYTON meets first Friday of each month in Engineers Club Secretary, Paul E. Geske, 41 S. Bromfield Road, Dayton 9, Ohio. Research Finance Committee Chairman, Robert L. Ruleff, 1002 Broadview Boulevard, Dayton 9, Ohio.

DETROIT meets first Friday of each month in Hotel Statler, Secretary-Treasurer, Joseph Gurski, 8885 Littlefield, Detroit 28, Mich. Research Finance Committee Chairman, W. B. Knight, c/o Knight Plating Company, 3143 Bellevue Avenue, Detroit 11, Mich.

GRAND RAPIDS meets second Friday of each month at 7:30 P. M. in Rowe Hotel. Secretary, Keith E. Yhouse, 915 Maylew-Wood Drive, S. E., Grand Rapids, Mich. Research Finance Committee Chairman, Harold Grutter, 1222 Gladstone Avenue, S. E., Grand Rapids, Mich.

HAMILTON BRANCH meets third Thursday of each month in the Conference Room, West End Plant, Canadian Westinghouse Company, Ltd. Secretary, H. Fallowes, c/o Electroplating Division, Steel Company of Canada, Canada Works, Hamilton, Ontario, Canada.

HARTFORD meets third Monday of each month in Hotel Bond. Secretary, Stanley Platoz, 26 Erwin Place, New Britain, Conn. Research Finance Committee Chairman, Frank W. Smith, 46 Cottage Street, Meriden, Conn.

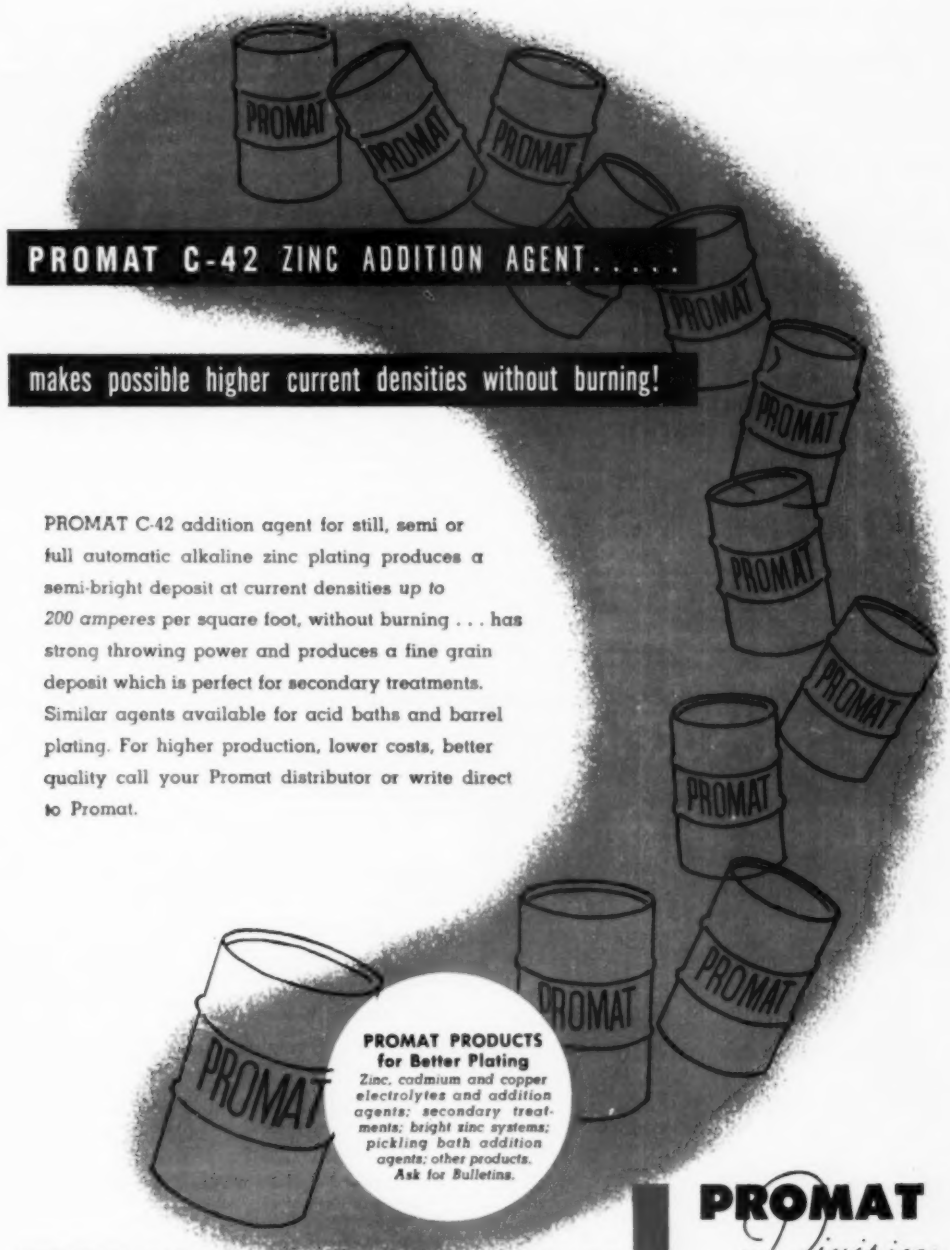
HOUSTON meets fourth Friday of each month at 7:30 P. M. Secretary-Treasurer, J. R. Byerley, Dixie Electroplating Company, 3001 Engelke Street, Houston, Texas.

INDIANAPOLIS meets first Wednesday of each month at Fox Steak House, 1207 E. Washington Street. Secretary, Edward Bruck, Platers Supply Company, 2311 Valley Avenue, Indianapolis 18, Ind.

JACKSON-LANSING meets second Tuesday of each month alternating between Hayes Hotel in Jackson and Porter Hotel in Lansing. Secretary-Treasurer, Fred Stuckenberg, P. O Box 501, Lansing 2, Mich.

LANCASTER meets second Friday of each month at 8 P. M in Thaddeus Stevens Industrial School. Secretary-Treasurer, Harry A. Saylor, 40 N. Poplar Street, Elizabethtown Pa. Research Finance Committee Chairman, Harry Hovis, Lincoln Highway, West Lancaster, Pa.

LOS ANGELES meets second Wednesday of each month at 6:30 P. M. in Rodger Young Auditorium. Secretary, Stuart Krentel, 495 Terrace Street, Altadena, Calif. Research Finance Committee Chairman, Jack Beall, 1272 Inverness Drive, Pasadena, Calif.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MELBOURNE, AUSTRALIA meets third Thursday of each month at 8 P. M. in Metallurgy Theatre, Melbourne Technical College, 124 Latrobe Street. Honorary Secretary-Treasurer, Rowland H. Keller, c/o Defence Research Laboratories, Maribyrnong, Victoria, Australia.

MILWAUKEE meets first Friday of each month in Red Arrow Club, 774 N. Broadway. Secretary-Treasurer, E. E. Piellusch, 2921 S. 90th Street, West Allis 14, Wis. Research Finance Committee Chairman, Phil J. Ritzenthaler, 1928 S. 62nd Street, Milwaukee 14, Wis.

MONTREAL meets first Tuesday of each month in Mount Royal Hotel. Secretary, L. A. Robillard, 3993 Lesage Street, Verdun 19, P. Q., Canada. Research Finance Committee Chairman, P. M. Coady, c/o Alloycraft, Ltd., 27 Hillside Avenue, Westmount, Montreal 6, P. Q., Canada.

NEWARK meets third Friday of each month at 8 P. M. in Hotel Robert Treat. Secretary-Treasurer, George Wagner, Hy-Grade Electro Plating Company, 35 Fourth Street, Newark, N. J. Research Finance Committee Chairman, Edwin Bowerman, 166-41 17th Avenue, Whitestone, N. Y.

NEW HAVEN meets second Tuesday of each month alternating between Sterling Chemistry Laboratory, Yale University, and Hotel Taft. Secretary-Treasurer, Clark A. Brown, 46 Loller Road, Hamden, Conn. Research Finance Committee Chairman, Dr. H. L. Kellner, c/o Lea Manufacturing Company, 16 Cherry Avenue, Waterbury 86, Conn.

NEW YORK meets second and fourth Fridays of each month in Statler Hotel. Secretary-Treasurer, George Schore, 150 Bennett Avenue, New York 33, N. Y. Research Finance Committee Chairman, George F. Hermann, 52 Chestnut Street, Brooklyn 8, N. Y.

PHILADELPHIA meets fourth Friday of each month in Harrison Laboratory Building, University of Pennsylvania, 34th and Spruce Streets. Secretary, I. William Marcovitch, 1434 Lardner Street, Philadelphia 24, Pa. Research Finance Committee Chairman, Robert H. Tiers, c/o Pennsylvania Salt Manufacturing Company, Box 4388, Philadelphia 18, Pa.

PITTSBURGH meets second Thursday of each month in the Avon Room of Sheraton Hotel. Secretary, R. H. Schindler, 125 Fairfax Road, Forest Hills, Pittsburgh 21, Pa. Research Finance Committee Chairman, S. S. Johnston, c/o Weirton Steel Company, Weirton, W. Va.

PROVIDENCE-ATTLEBORO meets third Monday of each month in Providence Engineering Society Hall, 195 Angell Street, Providence, R. I. Temporary Secretary, Dr. E. A. Parker, c/o Technic, Inc., 39 Snow Street, Providence 3, R. I. Research Finance Committee Chairman, Pierre B. Lonsbury, 78 North Avenue, Attleboro, Mass.

ROCHESTER meets third Monday of each month at Rochester Institute of Technology. Secretary, Charles B. Fideor, 180 St. Casimir Street, Rochester, N. Y. Research Finance Committee Chairman, Cecil Thornton, 20 Lafayette Parkway, Rochester, N. Y.

ROCKFORD meets second Monday of each month in Faust Hotel. Secretary, Kenneth Kieselburg, 419 Theodore Street, Rockford, Ill. Research Finance Committee Chairman, David Stockton, The Udylite Corporation, 1943 Walnut Street, Chicago 12, Ill.

SAGINAW VALLEY meets for dinner at 7 P. M. and meeting at 8 P. M. at Zenders, Frankenmuth, Mich., second Wednesday of each month, September through May except February. Secretary-Treasurer, Harlan L. Duley, 5074 School Street, Swartz Creek, Mich. Research Finance Committee Chairman, Alfred Knight, 113 S. Farragut Street, Bay City, Mich.

ST. JOSEPH VALLEY meets first Wednesday of each month at 8 P. M. in Hotel Elkhart, Elkhart, Ind. Secretary-Treasurer, Eugene Roth, 1720 Mishawaka Avenue, South Bend 15, Ind. Research Finance Committee Chairman, William McDowell, 211 Sycamore Street, Elkhart, Ind.

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SOUTHEASTERN meets second Friday of each month in Robert Fulton Hotel, Atlanta, Ga. Secretary-Treasurer and Research Finance Committee Chairman, Dr. Fred W. Cox, Jr., Engineering Experiment Station, Georgia School of Technology, Atlanta, Ga.

SPRINGFIELD meets fourth Monday of each month in Hotel Charles. Secretary, Edward F. Koetsch, Jr., 120 Oakwood Drive, Longmeadow 6, Mass. Research Finance Committee Chairman, James Laing, c/o Van Valkenburg Company, Montgomery Street, Willimansett, Mass.

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TOLEDO meets first Thursday of each month at Commodore Perry Hotel. Secretary, Gaston Bergeman, 703 Pine Street, Fremont, Ohio.

TORONTO meets second Friday of each month in Royal York Hotel. Secretary, Walter E. Mark, 761 O'Connor Drive, Toronto, Canada. Research Finance Committee Chairman, C. D. Short, 1281 Pape Avenue, Toronto, Canada.

TWIN CITY meets first Monday of each month, October through June, in the Covered Wagon (Lodge Room), 114 S. 4th Street, Minneapolis, Minn., with dinner at 7:00 P. M. and business and technical session at 8:00 P. M. Secretary-Treasurer, Robert L. Buckley, c/o Industrial Chemical & Equipment Co., 205 11th Avenue So., Minneapolis 15, Minn. Research Finance Committee Chairman, E. H. Lindemann, c/o Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

WATERBURY meets second Friday of each month in Elton Hotel. Secretary-Treasurer, Spencer L. Henn, P. O. Box, Dr. B, Cheshire, Conn. Research Finance Committee Chairman, F. T. Eddy, Box 339, Cheshire, Conn.

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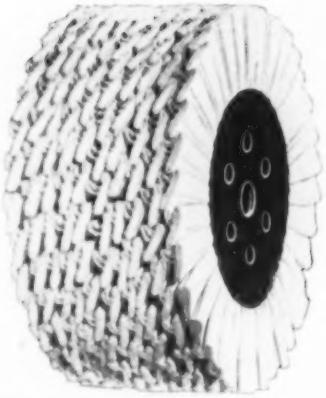

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LOS ANGELES BRANCH, A. E. S., Annual Technical Session and Dinner-Dance in Roger Young Auditorium on March 22.

CHICAGO INTERNATIONAL TRADE FAIR on the Navy Pier, March 22–April 6.

THE AMERICAN HOT DIP GALVANIZERS ASSOCIATION, INC., Annual Meeting in Drake Hotel, Chicago, Ill., on March 24–25.

BOSTON BRANCH, A. E. S., 17th Annual Technical Session (2:00 P. M.) and Banquet (7:00 P. M.) on April 19 in Hotel Statler.

ROCKFORD BRANCH, A. E. S., 10th Annual Educational Session and Banquet on April 19.

INSTITUTE OF METAL FINISHING, Annual Conference in Grand Hotel, Eastbourne, England, on April 23–26.

INDIANAPOLIS BRANCH, A. E. S. Annual Educational Session and Dinner-Dance in Indianapolis Athletic Club on April 26.

NEW ENGLAND REGIONAL MEETING, A. E. S., in Hotel Taft, New Haven, Conn., on April 26.

THE ELECTROCHEMICAL SOCIETY'S 50TH ANNIVERSARY MEETING in Benjamin Franklin Hotel, Philadelphia, Pa., on May 1–8.

3RD INDUSTRIAL FINISHING EXPOSITION AND 39TH ANNUAL CONVENTION OF THE AMERICAN ELECTROPLATERS' SOCIETY in International Amphitheatre, Chicago, on June 16–20.

A. S. T. M. 50TH ANNUAL MEETING in Hotels Statler and New Yorker, New York City, on June 23–27.

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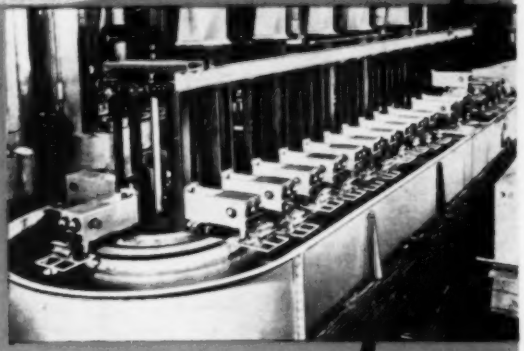

H-VW-M elevator-type full-automatic conveyor built during World War II to precision-plate bearings. Basically designed to provide independent control for each rack load.

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Today's precision plating is the direct result of the stricter demands created by World War II when ordnance parts were plated inside and outside with various thicknesses of deposits. H-VW-M made major contributions to this development . . . drew upon *Platemanship* to engineer and build conveyors able to meet the most stringent and exacting requirements.

Precision plating is again vital to defense . . . and H-VW-M is again ready to draw upon a tremendous backlog of knowledge and experience to provide conveyors precisely right for the task at hand. If you are seeking contracts for plating, pickling, cleaning or anodizing, why not look to H-VW-M . . . and *Platemanship* . . . to secure the right equipment for the job?

Write for Bulletin FA-103 for complete information of H-VW-M Full-Automatic conveyors.

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